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JANUARY, 1940

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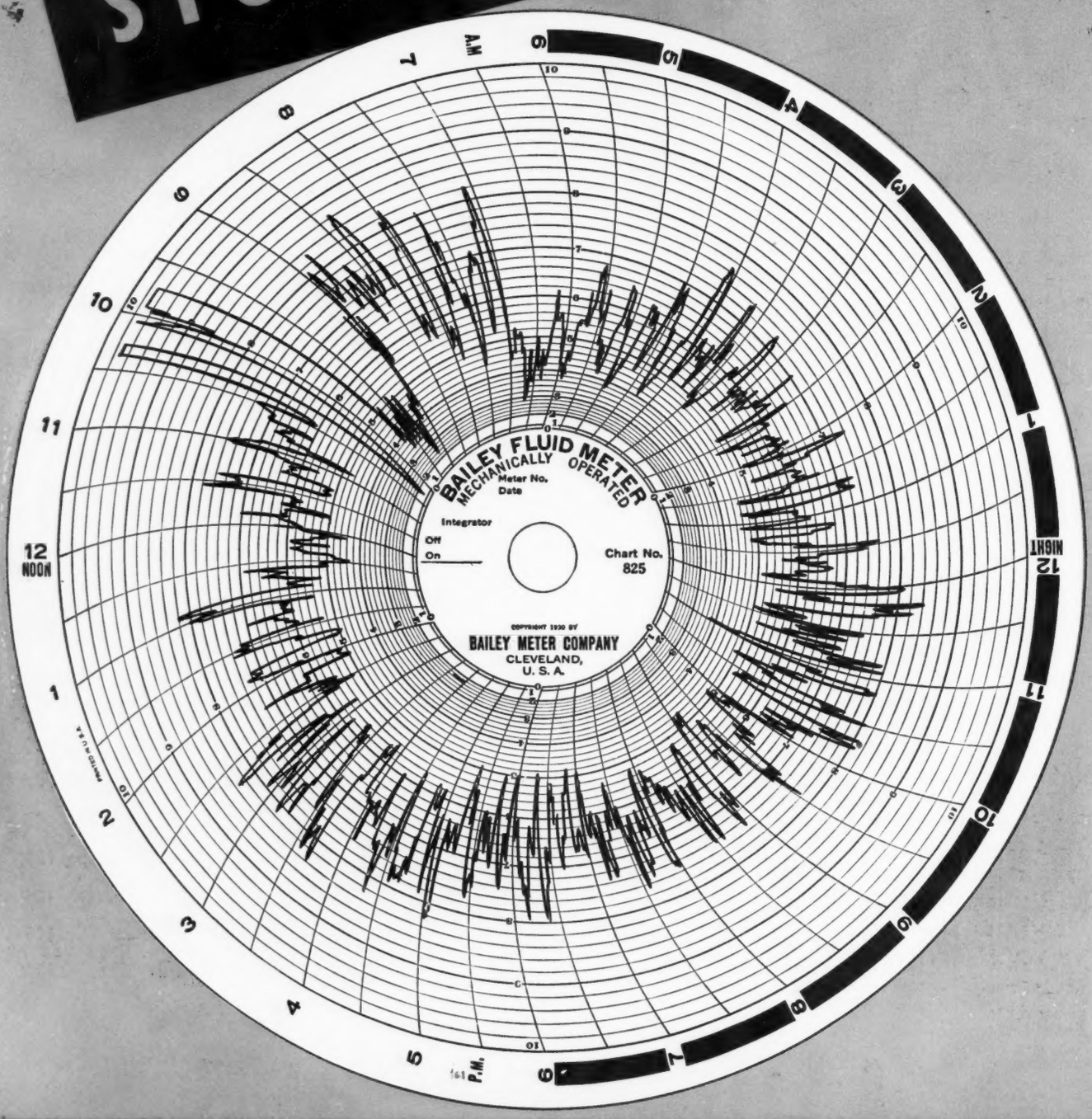

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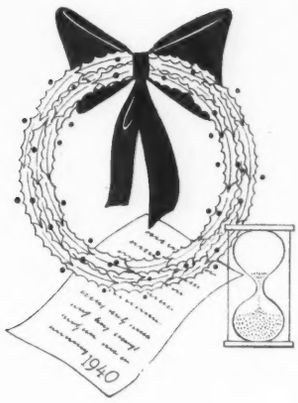


A Reasonable Greeting

The new year is here—the age-old cycle of winter, spring, summer, fall and winter.

Most of us will work with the same old gang, with a new face here and there.

Ours will be the same old job, pretty much, with a few minor changes. Same old hands and head to do the job with, a little better for experience, a little worse for wear.

Same old family, except that the new baby will be walking, the girl will be in high school, the boy in college or earning his living.

Same old world full of every contradiction—fighting and forgiveness—guns and generosity—selfishness and self sacrifice—every extreme of joy and sorrow.

According to the greeting cards, health, wealth and happiness are right around the corner for all of us. We appreciate the sentiment, but know it can't be so. Know that some will be richer, but some poorer, some happier and some more sad.

By the law of averages, most of us will hit the middle road—be fairly well, reasonably happy, getting by financially (but "could use more").

Viewing the world as it is and people as they are, we on POWER bring you a new kind of New Year's greeting. We wish you the attainable good things rather than some perfect state neither you nor we can ever reach.

Our sincere wish for you in 1940 is that you feel a little better than in 1939, earn a little more, master the job a little better, acquire a few more friends, bind the old friends a bit closer.

In short, we wish you a happier New Year!

1939—Year of Action

First in peace, then in war, power operations and technique advanced on all fronts—over three-quarters of a million kw of new utility capacity contracted for in the past four months, hydrogen cooling moves into the industrial field, the gas turbine proves itself workable

EVERY TWELVE MONTHS, POWER surveys the technical events of the year, to give busy readers a firm foothold on the next rung of the ladder of progress.

The year 1939, launched in an armed and precarious peace, can be viewed now only through the mists of the great war, or wars, that started with the September invasion of Poland by Germany and Russia. As long as this conflict lasts (and who can say how long), it must color every review of past events, every forecast of things to come.

When the war clouds burst over Europe four months ago, business here did not react as in 1914. The event had long been anticipated, if not actually expected, and its results discounted. Business indices shot up instead of down. Stock prices rose, material orders increased. Steel-manufacturing activity built up quickly to almost 100% of actual mill capacity.

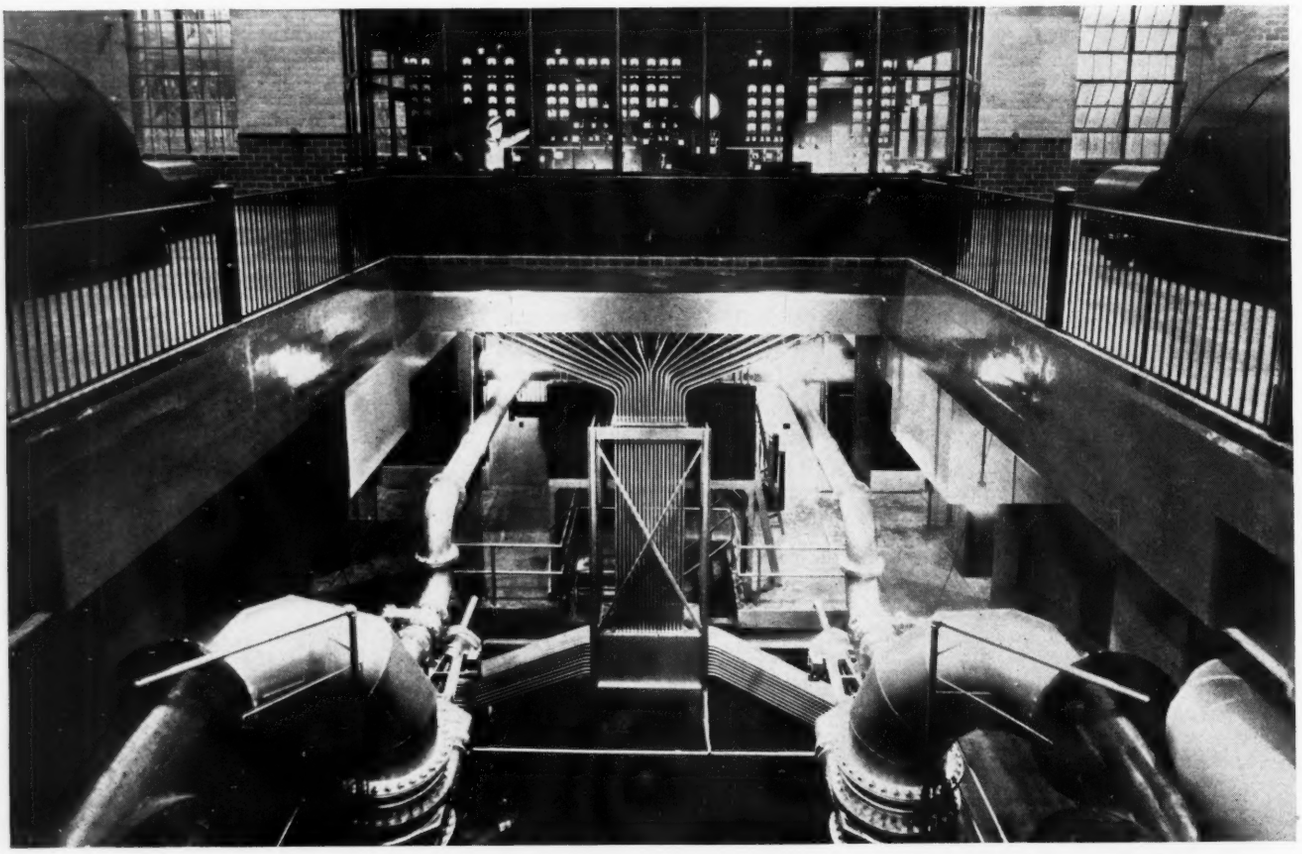
Yet American business did not "go crazy". Fearing a runaway situation, leaders counseled against profiteering, warned against over-expansion of plant, particularly for war orders. In general, up to this writing, Americans have "kept their shirts on."

In November, POWER said that there was no evidence supporting the probability of a shortage of utility power capacity, but that some industrial plants might expect difficulties with antiquated equipment if forced to go to a 7-day, 3-shift operation. A shortage of skilled labor was indicated.

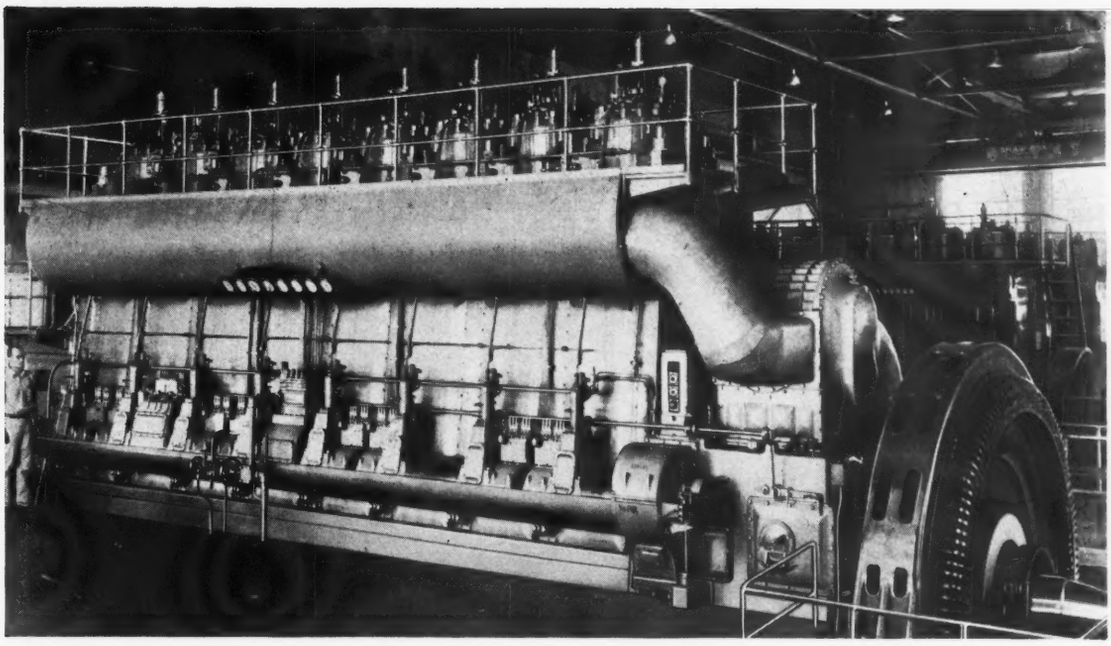
Pointing to the serious fuel shortages of the last World War, we said that they might or might not be repeated in the winter of 1940–41, depending on the ability of the railroads to handle the transportation load. There was no shortage of mine capacity in the last war and none is expected in this.

Readers were warned that war would probably dislocate fuel prices, raise the price of both coal and oil, but oil more than coal in the long run. It was important, we said, to insure fuel-burning versatility, to be able to shift quickly from one coal to another, or from oil to coal.

Some of the predicted irregular rises in fuel prices have already taken place. Already many plants have started



Condenser well of new Bryce E Morrow Station, Kalamazoo, Mich. Two 35,000-kw turbines take steam at 800 lb, 850 F



Newest and largest gas-oil convertible diesel—2700 hp. unit at Coolidge, Ariz.

checking their fuel-burning versatility. War or no war, this is a wise move simply from the angle of bargaining power. The plant that can burn a variety of fuels can select for lowest cost per million Btu of fuel chosen.

Utility Expansion

While complete data on utility peak loads is not yet available, indications are that many individual systems carried considerably higher loads than have ever before been recorded. Apparently, installed capacity was ample to carry the load, as no serious emergencies have been reported.

As for the future, over 1,400,000 kw are scheduled to go into operation in 1940, compared with slightly less than a million in 1939. Also, a million more kw are already scheduled for 1941.

These figures reflect the planning ahead by utilities to take care of the 2-year lag between placing of a turbine order and actual operation of the entire plant. Thus, 1939 has been a year of equipment *orders*, contrasted with 1938, a year of *construction*. The flood of orders in the last four months of 1939 exceeded three-quarters of a million kw—nearly an entire average year's capacity increase.

While load growth has been fairly steady over the years, moving forward even with depressions, recessions and wars, utility plant construction seems to proceed in cycles. This is the result of (1) market cycles affecting the saleability of stocks and bonds, (2) the general business index, reflecting the need for additional purchased power, and (3) effect of government policy. These factors affect all parts of the country and all utility systems to practically the same extent. Thus, the needs that dictate a new turbine in Philadelphia are similar and simultaneous with those that require added capacity in Denver. And so we have waves of buying, periods of construction and, last but not least, times when preliminary operating troubles engage most of the attention.

Operation of utility topping turbines and a survey of troubles encountered featured the power-panel discussion at the Annual ASME Meeting at Philadelphia last month. New machines, however, are mostly for condensing units. Obviously, most places where tops fit best have been developed.

Another trend in central-station design is worthy of more than passing mention. Just as a decade ago there were conditions to which 1200-lb pressure with reheat was best suited, and others to which 400- and 600-lb pressures were better adapted economically, several of the new orders have been for moderate-size 800-lb plants. Some degree of standardization, inherent simplicity, low first cost and acceptable economy favor use of moderate pressure. Where high load factor and maximum economy are important, 1200-lb, 900-F steam conditions continue in favor.

Among the 1200-1400-lb-pressure steam-generating units are four 615,000-lb per-hr for Waterside Station, New York, three 425,000-lb for Northwest, Chicago, two 285,000-lb for Westport, Baltimore, and one 375,000-lb for Commerce St, Milwaukee.

At 900-lb pressure, a few are four 400,000-lb-per-hr boilers for Duke Power, and similar units for the Mobile plant of Alabama Power and the Macon Station of Georgia Power. The 525,000-lb unit being installed at Buzzard Point, Washington, D. C., is designed for 775-lb. pressure, as are also the two 250,000-lb-per-hr units on order for Dresser Station, Terre Haute, Ind. Among others in this class are two 200,000-lb-per-hr units for Glendale, Calif., and another for Rochester, N. Y.

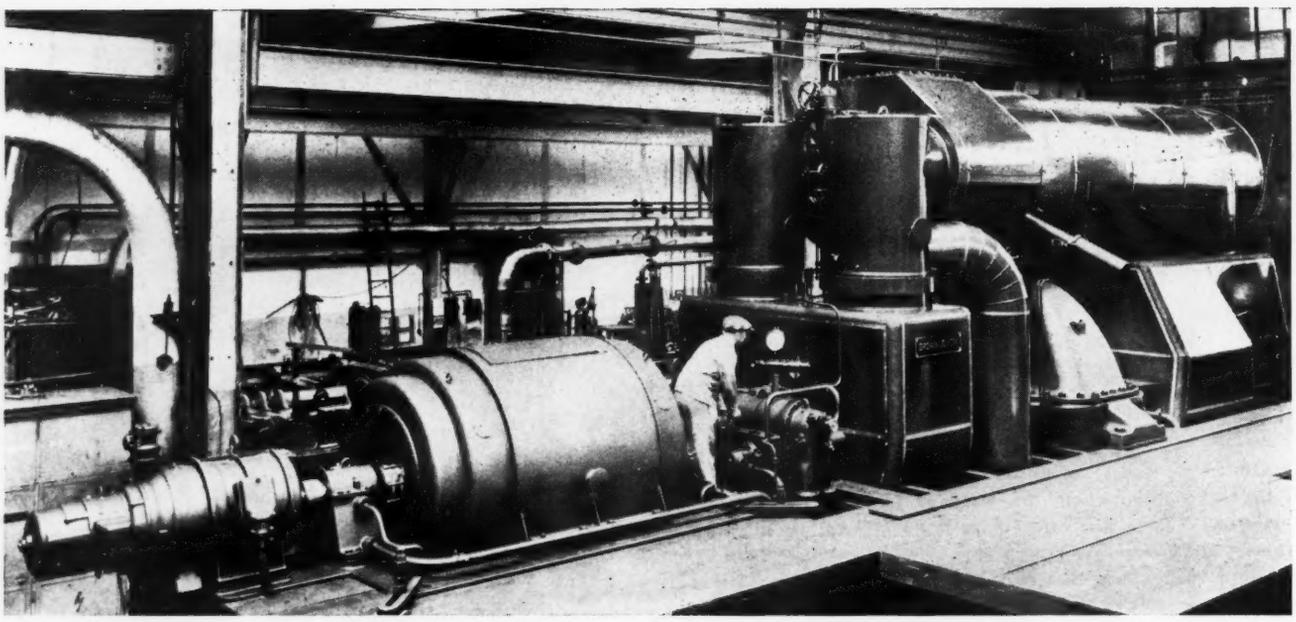
In all these installations, with one exception, total steam temperatures range between 850 and 935 F.

Industrial Steam Plants

Steam conditions for industrial plants continue to rise, following, as always, central-station practice. Most new industrials operate at 400-600-lb, at 800 F or higher. An increase in the number of industrial tops has also been noted.

In one respect, Diamond Alkali, an industrial power plant, is an acknowledged pioneer. Its 2500-lb boiler unit has been operating about six months, but no details have yet been made available for publication. The Ford, River Rouge, generator is the first steeple-compound unit to be hydrogen cooled, as well as the first such generator to serve industry directly.

Until recently, the reciprocating steam engine had almost a monopoly as a steam prime mover for institutions where exhaust was used for heating. The steam turbine has now made inroads into this field. In small sizes, and for fixed steam conditions, the steam engine normally has a considerably



World's first commercial combustion gas turbine for straight power generation. 4000-kw unit has been tested and is ready for installation as bombproof emergency plant for Neuchatel, Switzerland

higher efficiency than the steam turbine. Indications are, however, that the steam turbine can offset this disadvantage by operating at higher pressure and super-heat than are now customary in institutional plants.

European practice proves that engines can be built to operate at any pressure and at very high temperatures. The fact remains that American builders have almost always sold engines for moderate steam conditions; there is little demand for engines to operate at high pressures and temperatures.

Probably the most interesting byproduct power plants under construction in America are the three cooperative oil-refinery plants nearing completion in California (Martinez, Oleum and Avon). Owned and operated by the utility (Pacific Gas & Electric Co), these are, from an engineering angle, industrial plants. Each is alongside a large oil refinery, uses refinery waste fuels and delivers process steam and byproduct power to the refinery. Excess power is delivered to the utility system. Each of these plants has three 950-F, 1500-lb boilers fired by natural gas, oil and acid sludge.

Boilers and Firing

Pulverized fuel holds its lead as the generally favored firing method for large boilers, but with more frequent provision for the alternate or combination burning of oil or gas. The standardized steam-generating unit has won wide popularity in medium sizes.

The cyclone steam separator is a new development in boilers for high pressures and capacities. It is said to permit wider fluctuations of water level without excessive carryover. On the other hand, water level is reported to vary less with load. Finally, it is claimed that circulation is improved by delivering steam-free water to the downcomers.

In general, boiler designs of 1939 have fewer innovations than those of 1938, or 1937. Most of the recent changes have been minor improvements to eliminate troubles discovered in the preceding radical advance—poor circulation, slagging and carryover.

Stokers

Naturally, pulverized-fuel firing gets more attention than solid-fuel-burning equipment, because the former has acquired dominance in the larger-size central-station-type steam generators. A look back over 1939 shows that stoker developments have kept pace with advances in competitive firing equipment.

The traveling-grate unit at Omaha (275,000 lb per hr steaming capacity) has given an excellent account of itself. Several water-cooled stokers, notably Richmond, Ind., and Columbus, Ohio, have gone into service during the year burning low-grade Midwestern coals. Preliminary results indicate satisfactory operation at expected efficiencies.

Looking towards 1940, there may be a tendency to follow blindly the lead of large installations in selecting pulverized fuel where a stoker would or might do a better job. The situation at least merits consideration for every medium-sized plant; the balance is much in favor of stoker for smaller ones.

Newer-type furnaces, whether air or water cooled or a combination of the two, have demanded improved construction of suspended furnace walls to secure air tightness and reduce slagging. Manufacturers claim ability to build walls for this service.

Oil & Gas Firing

Automatic control of industrial oil and gas burners advanced notably in 1939; seemingly, manually controlled burners are rapidly going out of style. One recent 650-lb, 125,000-lb-per-hr steam generator represents a cost above $10,000 for five combination oil-and-gas burners and control. Fully automatic, this installation operates on Bunker C, without heating (at California winter temperatures), as smoothly as light-oil, electric-ignition domestic burners.

Turbines

When 1939 began, troubles with first-stage impulse blading threatened to become so important as to becloud confidence in new high-pressure high-capacity superposed turbines. Ingenuity of turbine manufacturers with helpful cooperation and patience on the part of operators, has licked the problem in one way or another so that, with the advent of 1940, none of the tops are out of service from this cause.

Much has been added to the store of knowledge during the year on the effect of the terrific impact of 900-F steam weighing 1½ lb per cu ft when the high-velocity jets hit blades suddenly, as happens at partial loads. Much heavier blade and shroud construction, straddle-root designs, full admission, all-reaction-blade turbines

are some of the more important answers. Increased facilities for research in blade shapes by air test have greatly increased the production capacity of laboratories and the effect of this additional data will have an important influence on turbines of 1940.

Hydrogen-cooled generators have met complete acceptance on the part of operators. The necessary differences in construction and operation to accommodate the new cooling medium have caused no serious complication or expensive maintenance. Hydrogen consumption of several units on which data is available runs from 25 to 40 cu ft per day, appreciably less than early conservative estimates. The field for hydrogen cooling on an economic basis seems to be for 3600-rpm units above 25,000 kw and 1800-rpm machines above perhaps 50,000 kw.

Instruments and Control

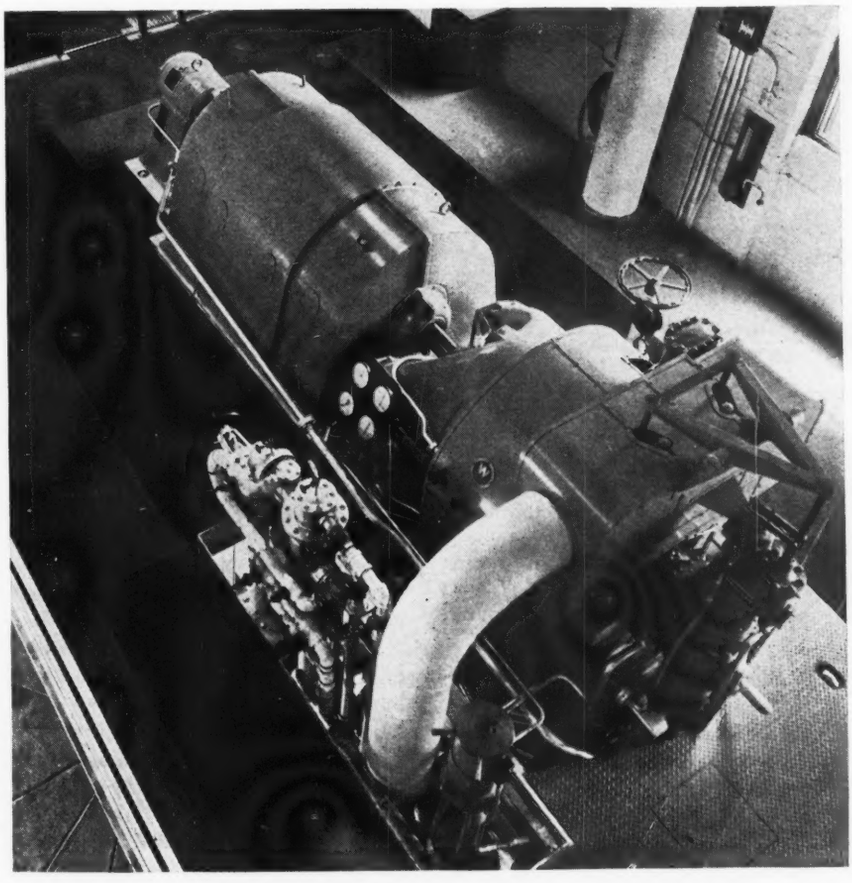
The practice of operating new central-station steam equipment at or near the temperature limits of piping, valves and turbines has markedly increased the demand for steam-temperature control devices.

Engineers are paying more attention to safety in boiler operation. For example, they show decided interest in better feedwater regulation, purge interlocks for cleaning furnaces of fuel gas before lighting, and flame detectors to signal loss of ignition.

With present-day plants, nothing less than centralized manual control is acceptable. Full automatic control, incorporating the necessary manual equipment, costs but little more than centralized manual control alone. As a result, complete combustion control is now generally taken for granted in all new large and medium-sized plants.

When fuel burns in suspension, instantaneous ratio of fuel and air supply must be held closely for best results. This requires simultaneous adjustment of fuel feed to pulverizer, air flow through pulverizer, speeds of both forced- and induced-draft fans, or position of two sets of dampers. It is now the concensus of opinion that properly coordinated mechanical equipment can make such adjustments far more rapidly and accurately than even the most skillful operator.

A number of central stations are requesting automatic controls for superheat dampers, to control flow of combustion products through the superheater, and thus hold steam temperature constant. This becomes particularly important with high temperatures.



Automatic-extraction, 3600-rpm turbine-generator at Utica Knitting Co takes all plant load up to its capacity, corrects power factor of purchased power

In central stations, the trend continues toward universal application of boiler-feed pump excess-pressure controls. These may or may not provide for automatic starting of standby pumps in case of failure of main pumps. Excess-pressure control permits parallel operation of constant-speed and variable-speed pumps in such a way that they will maintain the desired excess boiler-feed pressures, divide the load in desired proportions, and operate with complete stability at minimum power consumption.

Other control applications, common today, include continuous blowdown systems, regulated hotwell levels, chemical proportioning for boiler-feedwater treatment, controlled deaerator pressures, etc.

Diesels

Engines that burn either oil or gas are increasingly popular in areas where both fuels are available. Many are "convertible"; changing a few parts swings them from the diesel to the Otto cycle for gas. The alternative type, the "gas-diesels", designed to burn either oil or gas on the full diesel cycle, attracted much attention when introduced a few years ago. An outstanding 1939 installation was the 2700-hp unit at Coolidge, Arizona.

Gas Turbine

Power history will mark 1939 as the year in which the combustion gas turbine was first generally presented to the American engineering profession as a practicable, workable piece of equipment. With little publicity, three gas turbines have been operating for over two years on the discharge gas of the Houdry oil-refining process. The gas-turbine-axial-compressor unit supplies compressed air for the process; only the excess power goes to generate electricity. Of the 13 gas turbines so far installed in the world (not including the large number used on diesel-engine superchargers and Velox boilers), all but one are associated with the Houdry process.

The initial stages of the present development have been directed at producing primarily a large output of compressed air without need for external power supply. As a secondary, but important, byproduct, some excess electric power has been developed. Putting the shoe on the other foot, so to speak, the design of a gas-turbine set primarily for electric power generation presents no serious additional problems and may be viewed today as an accomplished fact.

The future of the gas turbine, either

as auxiliary to chemical process or as a power unit is hardly predictable at this early stage. The question is not one of practicability but of application. Much simpler than a steam plant, the gas turbine needs neither auxiliaries nor water supply. Inherently larger but probably less expensive than a diesel engine in corresponding sizes, fields of application do not greatly overlap. While fuel is restricted to oil or gas that will burn without solid residue, the possibilities of waste fuels, or even hot waste products of combustion, have not begun to be investigated.

It is sufficient for this review of 1939 to note that the gas turbine is here, fully developed and practical. However, it will not soon compete with the large steam turbine because of lower thermal efficiency nor with the reciprocating diesel because of lower limit of about 2000 kw in size of gas turbine. The latter must be viewed as a completely new prime mover with individual characteristics that only time and continued study can exploit.

Water Power

Because of general drought conditions over a large part of the country, 1939 was a poor water-power year. The hydro output of 1939 is about equal to 1938 generation, when 38% of the total energy was supplied by hydro plants.

About 700,000 hp was added to hydroelectric capacity in 1938, and another 300,000 hp in 1939.

Because of a 14% increase in total power generation in public-utility plants of all classes, and no increase in hydro, output from the latter dropped to 34% of the total—4% below 1938 and 2% less than 1920. In spite of government building of water-power plants, therefore, the relative importance of steam stations has not decreased.

Work continued on many important water-power developments during the year. Two new units were put into operation at Boulder Dam, making a total of eight 115,000-hp units and one 55,000-hp unit, an aggregate of 975,000 hp, which makes it the largest *hydro* plant in the world. When the two 115,000-hp units on order are in operation, Boulder Dam will be the world's largest *power* plant—steam or hydro.

At the close of 1938, three 150,000-hp main units and two 14,000-hp service units were ordered for Grand-Coulee, scheduled for operation in 1941. Orders have also been placed for four 103,000-hp units for Shasta-Dam project in California; three 40,000-hp units for Parker Dam on the Colorado River 150 miles below Boulder Dam.

TVA ordered two more 45,000-hp units for Wheeler Dam, raising the capacity of this plant to 180,000-hp. Three 40,000-hp fixed-blade, two 40,000-hp and one 13,000-hp adjustable blade propeller turbines were ordered for the Santee-Cooper project of the South Carolina Public Utility Authority.

Safe Harbor Water Power Corp ordered an additional 42,500-hp adjustable-propeller turbine for its Safe Harbor Plant on the Susquehanna River. The turbine will drive a 25,000-kw single-phase generator and increase the total capacity of the plant to 255,000 hp in six units.

About 2,000,000 hp of new hydro capacity is on order now. When installed, by the end of 1942, it will raise the total for this country above 20,000,000 hp.

In the electrical field 1939 was marked by the extension and improvement of existing practice, rather than by outstanding new developments.

Hydrogen cooling, first applied in 1937, became practically standard for large high-speed turbine generators. Eighteen such units, totalling 1,070,000 kva, are now in operation. Largest of these is the 175,000-kva, 1800-rpm unit at State Line.

The electrical year was notable, also, for the rapid commercialization of the new fluorescent tubular lamps, whose lumen output per watt is about three times that of filament lamps.

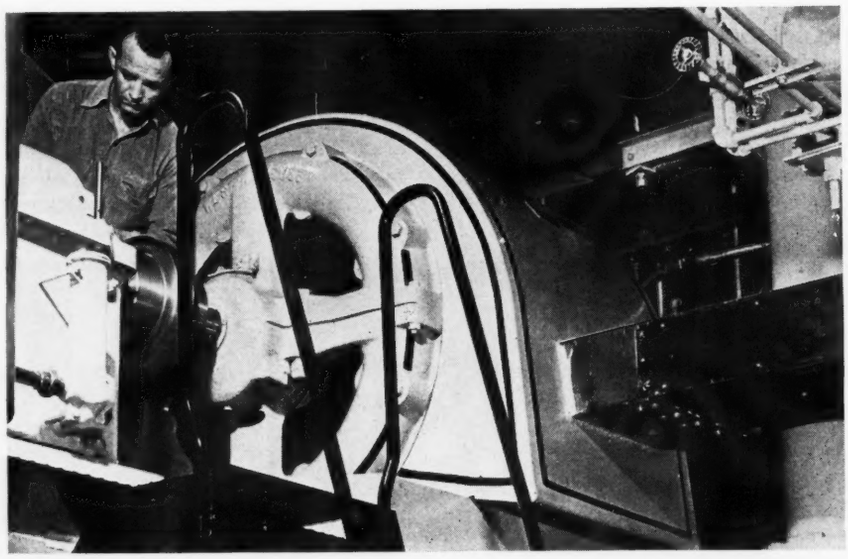
Mechanical Transmission

Recent years have been notable for a rapid increase in the use of hydraulic couplings for variable-speed drive, particularly of fans and pumps. In 1939 the electro-magnetic, variable-speed drive became available for similar applications.

Both of these devices, fundamentally, reduce speed by the simple process of "slipping". With either of these a 10% speed reduction involves a 10% waste of power supplied to the driving shaft. They cannot therefore be operated economically when driving constant-torque loads at large speed reductions. Fan and pump loads, on the other hand, vary as the cube of the speed, leaving a large net saving at reduced-speed operation, in spite of the slip loss in the coupling.

Air Conditioning

Among the outstanding air-conditioning installations of 1939 (first operation) was that in Industrial Rayon's new $11,500,000 factory at Painesville, Ohio. Ammonia compressors aggregating 1800 tons capacity are driven by 1600 hp of synchronous motors. All ammonia expansion takes place within the power-house walls, requiring brine circulation up to 5200 gpm. There are 13 complete air conditioning units, the largest requiring 400 motor hp to circulate 500,000 cfm.



More power for air conditioning. 1000-hp motor drives centrifugal compressor to condition new International Bldg at Rockefeller Center, New York

Because today's customers demand quiet, as well as the right temperature, humidity and cleanliness, more attention is now given to low sound level in machines for comfort conditioning and to the sound isolation of the equipment.

An example is the new ultra-modern metal-working plant of Simonds Saw & Steel Co, Fitchburg, Mass. The 5-acre, single-room factory is windowless, acoustically treated to deaden noise and

completely air conditioned. More than 1400 100-watt fluorescent lamps provide uniform high-level illumination.

The fire hazards of air conditioning were publicly faced. Clearly, an unprotected system can act as a breeder and spreader of fires through the ductwork. The needed precautions have been well established. (See POWER, August, 1939, page 88).

Heat Pump

Early in the year a heat-pump installation started operation in the new Westinghouse Building at Emeryville, Calif. Building is 90 ft long, 50 ft wide and two stories high, heavily insulated. Two 7½-ton condensing units supply heat in winter, cold in summer. Under heating conditions at Emeryville, each kilowatt hour delivers the equivalent of 5 kwhr of direct heating effect through the heat pump.

In water conditioning, the complete solution of all troubles is always "just around the corner," but great progress was made in 1939. These included further development of the hydrogen-zeolite type of softener, adaption of the Spaulding tower principle to the removal of silica from raw water, demarcation of the pH values (especially in their lower range) permissible in boiler water, better understanding of steam-bound conditions in boilers, better understanding of embrittlement and embrittlement protection, steady advance in the separation of boiler water from the steam in the steam drum.

Attention is spreading from dissolved oxygen, in boiler water and feedwater, to other dissolved gases. Devices to remove ammonia and CO_2 have been developed. Another new device measures free hydrogen in steam and thus determines indirectly, the oxidation of boiler metal from disassociated water.

Shot-gun treatments and secret "boiler compounds" are falling more and more into disrepute. The trend is toward specific prescriptions based on detailed study of local conditions.

Smoke and Dust

While the electrostatic precipitator still ranks first for the completeness of its removal of dust particles of all sizes, including extremely fine dust, many plants are now installing various types of mechanical separator. When well designed, these function very satisfactorily to remove all dust sizes that would settle within the "acute range." Some engineers feel that the importance of removing the ultra-fine dust particles has been over-emphasized.

Incidentally, the present electrostatic precipitator installed at Lansing makes provision for later installation of mechanical separators in series to remove coarse particles.

Removal of dust from hot gas by direct filtration steps forward with the newly available finely woven filter cloths of glass fibre. These are easily cleaned and can withstand working temperatures as high as 900 F.

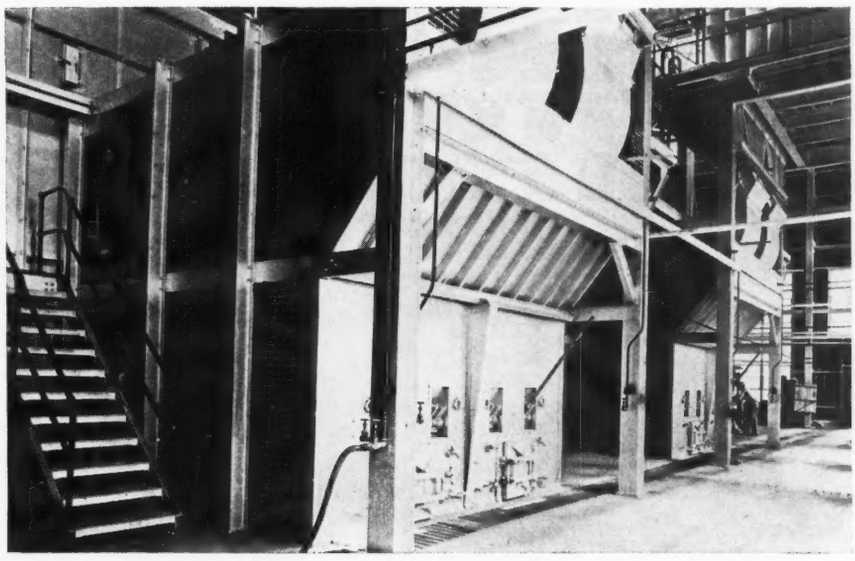
Metals

Early metal-spray equipment worked by blowing fine metallic particles from the molten end of a wire. Some of the new guns use a powder in the "pistol". Thus the user can "Mix his own" spraying materials for special purposes. Mixtures of tin, zinc and silica have given useful protective coatings for some purposes. Plastics, also, are successfully sprayed.

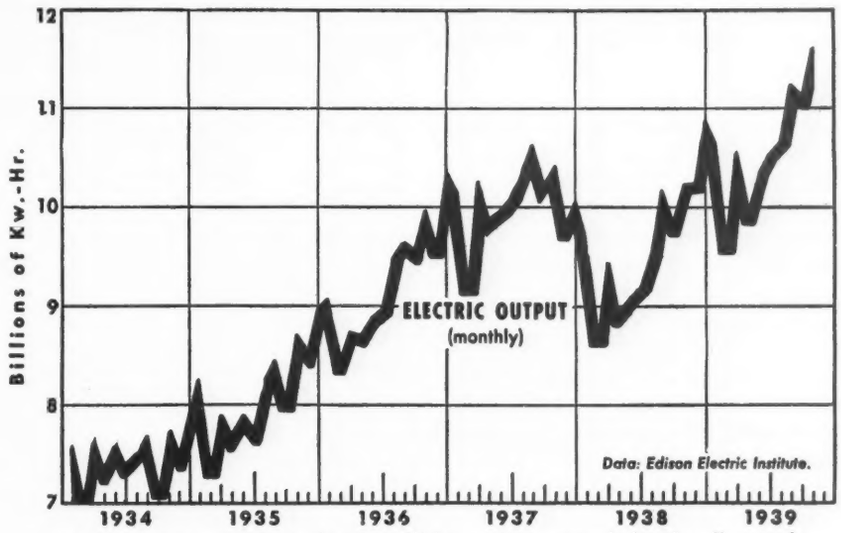
Stelliting is used more than ever for hard surfacing valve surfaces, but other materials for the purpose are now being investigated. In general, the gradual raising of steam temperatures is forcing manufacturers of valves and similar equipment to strengthen their research departments, particularly along metallurgical lines.

Welding ends for valves are becoming so common that few flanged connections may be used in the future for steam pressures above 400 lb. Welding, of course, is now a standard power tool, both in manufacturing and maintenance. The importance of the torch as a dollar-saving cutting tool finds increasing recognition.

[*The steam and hydro-plant tabulations customarily presented with the year's review has been set over to the issue of September 1940, to permit inclusion of the exceptional construction activities anticipated for the first half of 1940.*—Ed.]



Modern bark-burning furnaces at St. Joe Paper Co, St. Joe, Fla.



Weekly energy output of electric utilities sweeps upward, breaks all records

Water-Cooled Stoker for Richmond

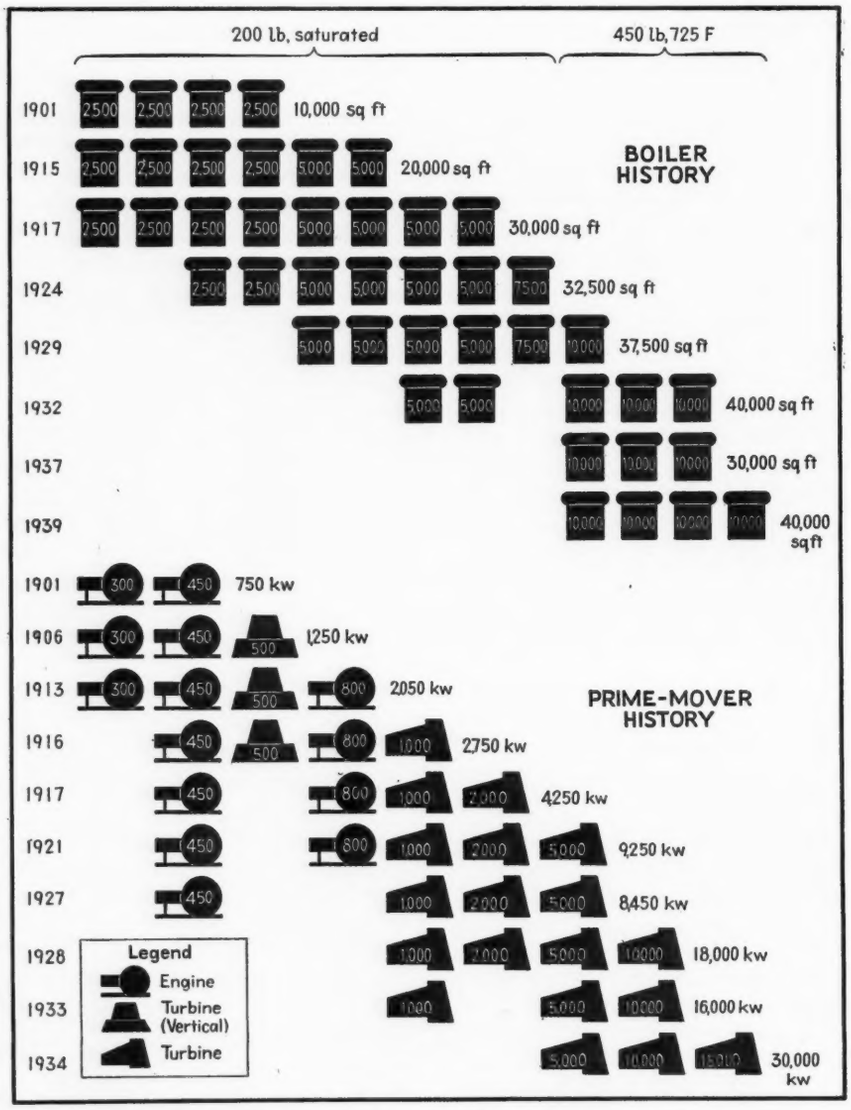
Indiana municipal plant continues modernization by adding 100,000-lb-per-hr boiler fired by an underfeed unit designed to handle economical local coals

INSTALLATION of a 100,000-lb-per-hr boiler fired by Indiana's first water-cooled stoker continues the progressive municipal-plant modernization and expansion that has brought Richmond the lowest electric rates in the state. Coupled with extensions made in 1932–34, this steam-generating unit will insure ample capacity for expected load growth as industrial activity increases, and will further reduce operating costs.

Richmond, Indiana, a city of about 33,000, has had municipal service since 1901: the chart shows graphically the changes that converted the old hand-fired, engine-driven plant to the present modern station. The plant has written off its original bonded indebtedness, paid for all modernization and expansion out of earnings, and turned over to the city treasury amounts in excess of what taxes would have represented (slightly over $1,500,000 in the last 5 years). Recent campaigns have increased domestic consumption and added diversified blocks of industrial load. It is to meet these increases, and expected future gains, that the current modernization program was begun in 1932.

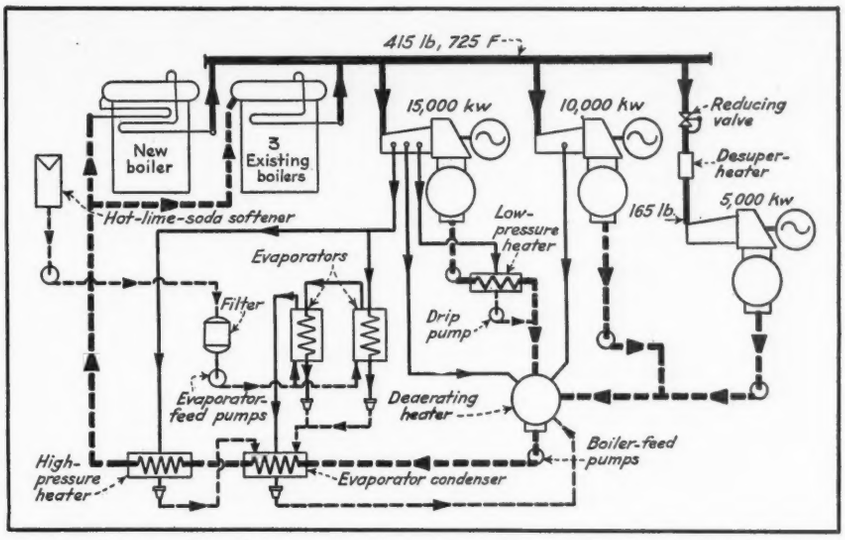
New Power Equipment

At that time, the plant operated at 165 lb. The obvious step was to increase this pressure and so improve the cycle efficiency. A tentative step was taken in this direction in 1929 when a 10,000-sq-ft B & W boiler was installed; this unit was operated at the old pressure but designed for future use at 450 lb. In 1932, two additional steam generators (Foster Wheeler) went into service, a 10,000-kw turbine-generator was revamped for 450-lb operation, and a new 15,000-kw high-pressure unit was ordered. The flow diagram shows how these additions were fitted into the original extremely simple heat balance. One 5000-kw low-pressure turbine was retained and supplied through a reducing-desuperheating station.



Graphic history of Richmond municipal plant's growth

These three high-pressure boilers resemble each other closely in arrangement and accessories. All are 3-drum bent-tube units, with tubular air heaters. A Westinghouse underfeed fires the first unit, and Taylor underfeeds the latter two. Hele-Shaw drives give fuel-feed variation on all three units, under regulation of automatic Bailey electric controls. A single forced-draft fan, driven by a variable-speed motor, supplies each



Flow diagram shows how new units were fitted into original simple heat balance

boiler and similarly driven induced-draft fans discharge into evasé stacks.

These units were designed for, and operated on, an Eastern 2-in. nut-and-slack, a high-grade steam coal, which permitted continuous operation at capacities up to 90,000 lb per hr. Shifting fuel prices made midwestern coals more economical since 1934–35, in spite of lower heating values and loss of boiler capacity. Use of Indiana coal limited the maximum output of these units to about 55,000–60,000 lb per hr, each. Experience showed that air-heater and stoker maintenance costs ran high with these coals, also.

Future Conditions

The coal situation was thus an outstanding factor to be considered when the time came to extend the boiler plant. Perhaps even more important, thought had to be given to the entire future development of the station, because of the condensing-water situation. A detailed analysis of past load experience led to estimating a peak of about 15,000 kw in 5 years (1943). A study of flow condition in the Whitewater River indicated that the maximum load the plant could handle without extensive expenditure in spray ponds or dammed storage was about 20,000 kw. To meet loads beyond this point it would be more economical to build a completely new plant at another site.

By calculating the steam loads expected during the period of growth to the ultimate plant load and by fitting different combinations of steam-generating equipment to these loads, it was found that two 100,000-lb-per hr boilers constituted the best solution. It was decided to install one such unit first.

Facing the specific problem of burning Indiana coal economically, the engineers considered stoker and boiler alone, stoker and boiler with air heater, stoker and boiler with economizer, and pulverized-coal firing with preheated air. Preliminary evaluations showed pulverized coal and the stoker-economizer combination to be the best bets, with little to choose between them. Specifications were drawn up on the basis of both and further comparison was based on the actual proposals of the manufacturers.

Stoker Selection

With due allowance for reluctance to introduce pulverized-coal firing into a plant already equipped with stokers, the stoker-economizer combination was finally chosen. Use of an economizer instead of an air heater showed better over-all efficiency and promised heavy maintenance savings. These would come from the elimination of heavy air-heater upkeep and from reduction in stoker-metal replacement, partly caused by use of preheated air. Maintenance considerations also largely influenced the final choice of water-cooled stokers, specifically designed to handle the low-grade coals of the Midwest.

The new boiler is a B & W Stirling, with fusion-welded drums and 10,112 sq ft of boiler surface. Waterwalls line the furnace on all four sides; the stoker

RESULTS OF STEAM-GENERATING UNIT ACCEPTANCE TESTS

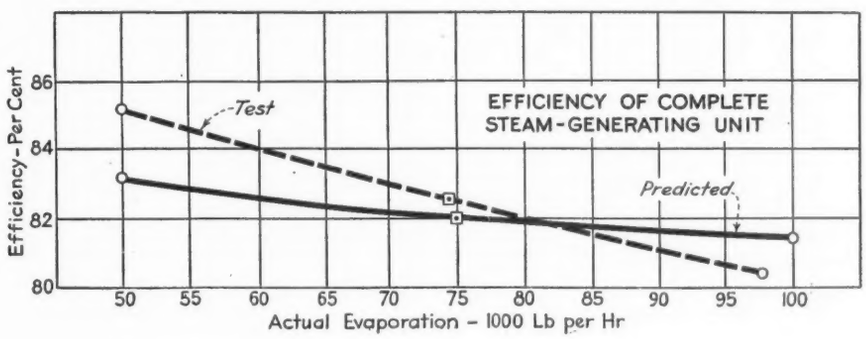
HEAT BALANCES

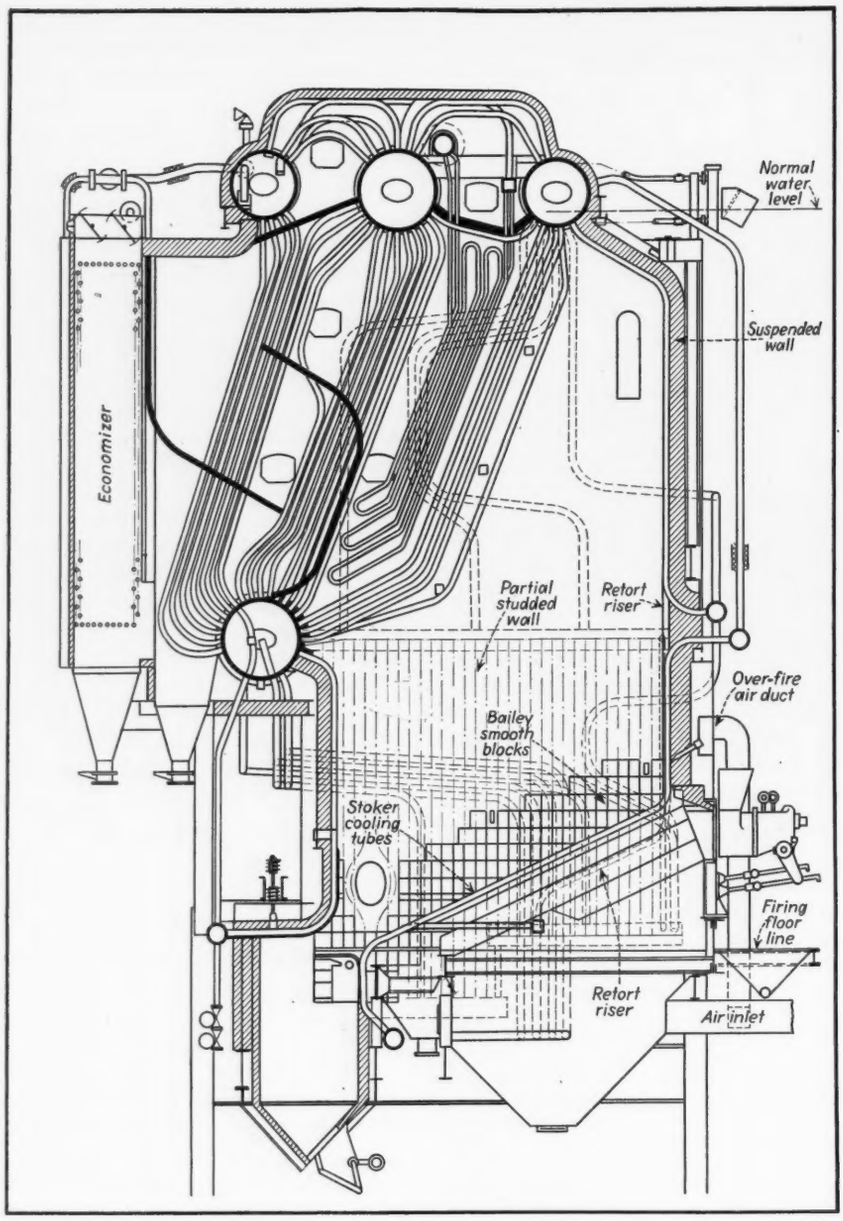
	50,000 lb/hr	*75,000 lb/hr*	*100,000 lb/hr*
Heat absorbed by water in economizer	3.32%	4.04%	4.07%
Heat absorbed by water and steam in boiler	71.45	67.05	64.60
Heat absorbed by steam in superheater	10.47	11.50	11.67
Heat absorbed by steam-generating unit	85.24	82.59	80.34
Heat loss due to moisture in coal	1.13	1.31	1.22
Heat loss due to water from combustion of hydrogen	4.31	4.31	4.21
Heat loss due to moisture in air	0.14	0.17	0.17
Heat loss in dry stack gas	6.83	8.25	8.63
Heat loss due to unburned gaseous combustible	0.00	0.00	0.00
Heat loss due to unconsumed combustible in refuse	1.44	1.54	2.80
Heat loss due to unconsumed hydrogen, hydrocarbons, radiation, unaccounted for	0.91	1.83	2.63
Sum of losses and heat absorbed	100.00	100.00	100.00

COAL ANALYSIS

(*as fired*)

Moisture content	10.92%	12.06%	11.35%
Ash content	9.94	9.24	9.45
Volatile matter	37.31	37.63	37.47
Fixed carbon	41.83	41.07	41.73
Heating value, Btu per lb	11,437	11,337	11,384
Sulphur content	4.30	4.11	4.21
Fusion temperature of ash	2117 F (softening) 1960 F (initial deformation)		





Cross-section shows boiler and water-cooled stoker

OPERATING RESULTS

Month	*August 1939*	*September 1939*	*Total*
Total steam generated, lb	45,233,500	44,690,000	89,923,500
Average steam per operating hr, lb	60,800	62,000	61,400
Total coal burned, lb	5,194,800	5,270,600	10,465,400
Average evaporation, lb, steam per lb coal	8.7	8.5	8.6
Combined efficiency	86.5%	84.2%	85.2%

OPERATING CONDITIONS

435 lb gage at suphtr outlet	Total heat per lb of steam generated..... 1358 Btu
700 F total temperature	
270 F feed temperature to economizer	Heat in feedwater to economizer (above 32 F)..... 238 Btu
11,300 Btu (as fired) (Indiana coal) 2150 F Fusion	Heat added per lb steam generated..... 1120 Btu

cooling tubes, running up the grates and into the front wall, give virtually complete six-side cooling. The pendant superheater contains 3139 sq ft; the return-bend economizer 3350. The boiler has a suspended-wall setting.

A 9-retort water-cooled continuous ash-discharge stoker with a projected area of 262.8 sq ft fires the unit. It is capable of burning sufficient Indiana coal to generate 120,000 lb per hr. A Hele-Shaw drive takes care of stoker-speed variation on this unit, as on the existing stokers.

Ash hoppers below the grates receive the continuous ash discharge, which is quenched preparatory to periodic removal in rubber-tired hand ash barrows. These are emptied into the dump hopper of a skip hoist which raises the ash to an overhead yard hopper. The usual hoppers below the windbox, extension grates, and last pass of boiler and economizer, take care of siftings.

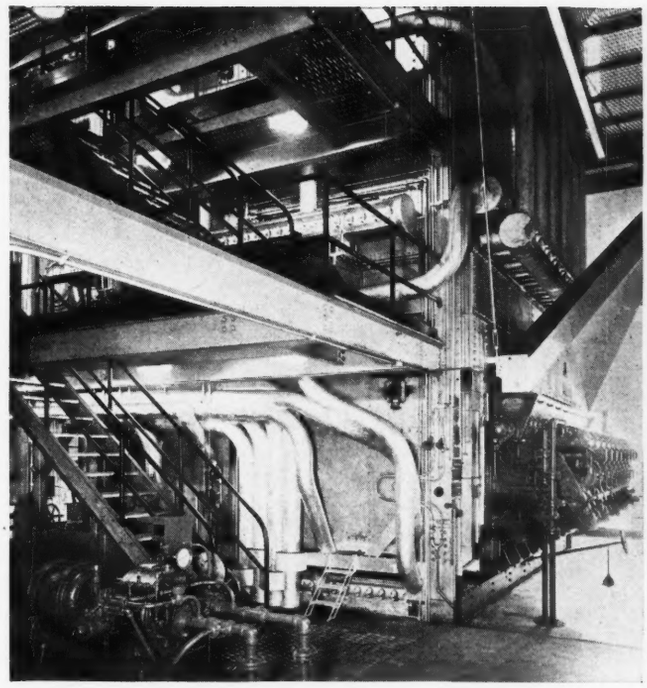
Extending existing coal-handling facilities met the needs of the new boiler. Hopper-bottom railroad cars run out on a concrete coal dock and discharge. After crushing, two vertical coal elevators transfer coal to bunkers outside the boiler house on the east side. A conveyor running the length of the boiler house serves these bunkers. Coal feeds to the new stoker by way of a Richardson scale and a non-segregating chute.

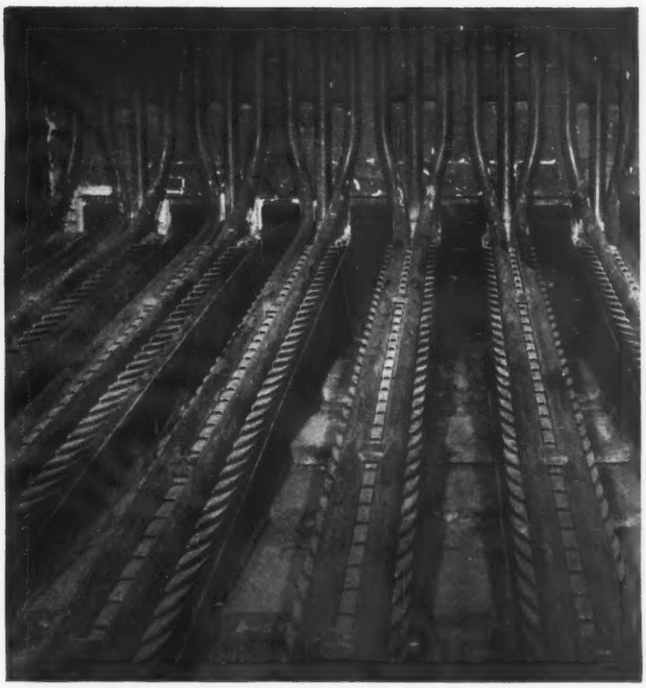
Draft Control

Draft arrangements for the latest boiler represent an advance over the older units in the direction of simplicity and economy. A single-speed motor drives the vane-controlled forced-draft fan. The induced-draft fan is equipped with a dual drive, giving economy of operation with a smaller motor at light loads. Automatic combustion control (Hagan) coordinates draft apparatus and stoker-drive mechanism for efficient combustion.

A separate panel carries Bailey steam-flow air-flow meters for the new unit, as well as a Hays CO_2 recorder and the necessary indicating draft gages. A Copes regulator control feedwater flow and drum level.

In accordance with the policy of the Municipal Electric Lighting & Power Plant, the new steam generator was subjected to a thorough-going acceptance test, following the ASME Power Test Codes. The charts and tabulation of heat balances at various loadings indicate the results. It can be seen that the test results exceeded guarantees except at high rating. The slight difference at this point might be attributed to difficulty in maintaining the required load during the month of July, when the





Water-cooled stoker with Hele-Shaw drive fires new boiler; closeup shows stoker-cooling tubes

test was run. In the opinion of the engineers, the steam-generating unit met the guarantee satisfactorily.

The new boiler and accessories have now been in operation for about 9 months; during the bulk of this time it has been carrying the lion's share of the steam load. Evaporation under actual operating conditions runs about 8.5 lb per lb of coal, with coal having an average heating value of 11,250–11,300 Btu per lb. Stoker maintenance has, of course, been low. Operators are watching this figure like hawks, to see if this water-cooled unit is the answer to their coal-burning problem. Additional figures will be forthcoming in a year or so that should prove of real interest to stoker operators in the Midwest.

Engineering studies leading to the selection of the new steam generator and the acceptance testing were carried out by the city's consulting engineers, The Commercial Testing & Engineering Co of Chicago, with H C Carroll in charge. W R Stevens heads Richmond's progressive Municipal Electric Lighting & Power Plant, and operating responsibility falls on Earl Mutchner, chief engineer.

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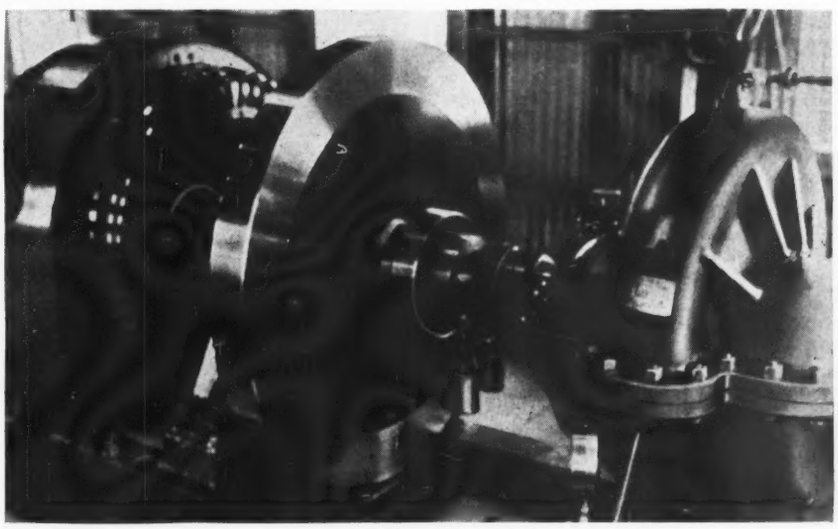
Flywheel on Pump Soft-Pedals Pipeline Surges

THE PHOTO shows one of two 9400-gpm pumps for a total head of 284 ft, equipped with a flywheel and built by the Dominion Engineering Co for the Yukon Consolidated Gold Corp, Dawson, Canada. Each pump is driven by an 800-hp, 1200-rpm motor and discharges into a 42-in pipeline about 900 ft long. A conventional type pumping unit of this size would have a flywheel effect (WR^2) of 1450 lb-ft^2.

If power failed to such a pump, reverse flow would begin after about 0.8 sec. This means that the check valve must close quickly to prevent reverse flow, which can cause high-pressure surges and slamming of the valve on its seat. This difficulty was overcome by equipping each pump with a flywheel of a WR^2 equal to 5500 lb-ft^2, making the total WR^2 of each rotor equal to 6950 lb-ft^2.

The flywheel increases the time to 2.42 sec before reversed flow begins if power fails. This is enough for the check valve to function properly, which reduces the pressure rise from 108 ft above normal to 48 ft when the valve closes. As an added precaution on this installation, check valves are equipped with time-adjustable dashpots which cushion the final closure and prevent slamming of valves. Operating experience with these units has shown very satisfactory performance.



Loudspeaker System Wraps Up the Power Job

At RCA Mfg Co, Camden, N. J., power operators get teamwork and quick action with a system of loudspeakers and microphones that coordinates all phases of operation

Fig. 1—Chief Frankhauser can find out what's going on without leaving his desk

A VISIT to the power plant of the RCA Mfg Co, Camden, N. J., is mighty near an education in itself, for there you will see a plant smartly and efficiently run. Also you will see a plant that knows the value of keeping cost records, but that's another story, one which we hope to tell in a later issue. This article concerns a modern loudspeaker system, devised by RCA engineers, that synchronizes all phases of the power-operating set-up.

Power Equipment

This up-to-the-minute plant, which supplies power and steam to 27 large RCA manufacturing establishments, was completely modernized in 1936-37 by installing two 120,000-lb-per-hr boilers operating at 900 lb, 750 F, and two 2500-kw, 850-lb, 750-F turbines connected to two existing 2500-kw, 0.80-pf, 2300-volt generators. There are also seven 5500-sq-ft boilers operating at 175 lb, 450 F total temperature, supplying two 1250-kw and two 3500-kw turbines connected to 2300-volt, 0.80-pf generators, making a total plant capacity of 14,500 kw and 350,000 lb of steam per hr.

Adequate proof of the fact that the power personnel at this plant is interested in efficient and smooth operation is the loudspeaker system for centralized control. Practically (and the system really is practical), the set-up consists of loudspeakers placed at strategic points throughout the power plant, with a "mike" in the chief engineer's office, on the operator's desk in front of the generator switchboard, at the boiler control panel in the boiler room, at the top boiler level, in the pump and con-

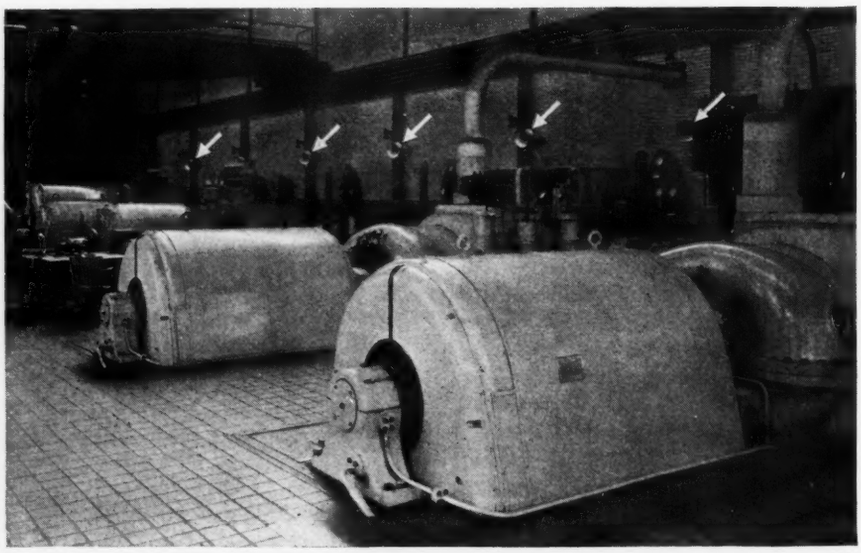


Fig. 2—Loudspeakers (see arrows) reach every sq ft of the turbine room and other parts of the power house. 51 are spotted strategically throughout the plant

denser room, and in the fan room over the top boiler level.

Fifty-one speakers give full coverage to every sq ft of floor space. This arrangement, see Fig. 2, was found to be more efficient than a few high-powered speakers projecting from the center of the plant.

Early trouble spot, now ironed out, was the turbine room. There, low-frequency hum of the generators interfered with hearing. This problem was solved by putting special filters on the speakers to take out low frequencies. Now, speakers emit high-pitched sound audible through the generator hum.

Sudden Changes Met Quickly

The Chief can talk to any of his men, and vice versa, without anybody having to leave his post. Switchboard operators can inform firemen on load conditions, and in case of sudden load changes, the operating engineer can notify the switchboard operator, firemen, shift supervisor, and any other men needed to handle the new conditions. In fact, when any operator has something to say to another, not only do the two talk to each other, but all operators, including the chief engineer, hear what's going on, regardless of where they may be.

Fig. 3—The boiler operator can signal for more feedwater and get immediate response

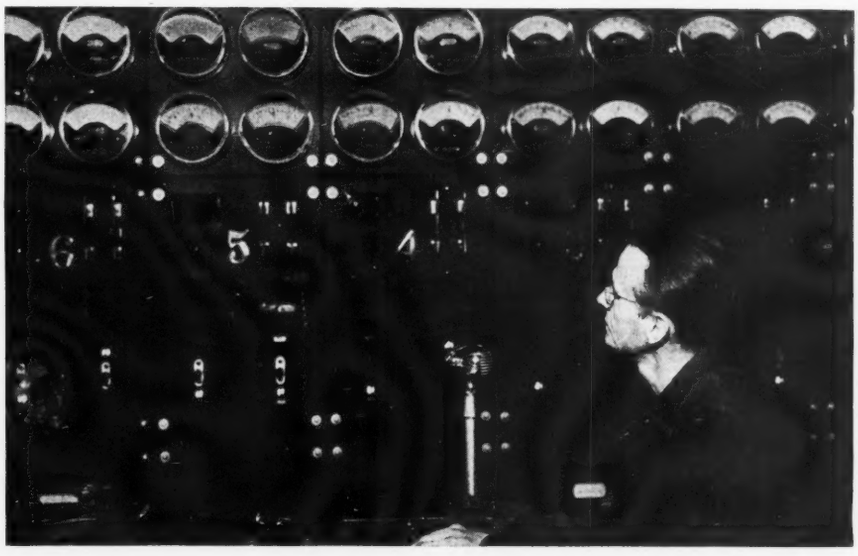


Fig. 4—Load swings don't bother the switchboard operator at the RCA Mfg power plant because he can tell turbine and boiler floors about them in a hurry

Besides providing a close and direct tie between turbine and boiler rooms, one of the most effective jobs this system does is to team-up operators in the fan room and on the boiler-firing level. When boilers are put on the line, it is occasionally necessary to switch part of the automatic control system to manual operation. In such cases, boiler and fan operators are able to signal each other for quick action.

Naturally, this system is saving valuable time. And perhaps most important of all, in an emergency it will gather all operators and maintenance men to the spot when seconds count.

Chief engineer E V Frankhauser and assistant engineer W H Andrew, RCA Mfg Co, Camden, N. J., supplied the information for this article.

Meters, properly applied and used, make large savings in power- and industrial-plant operation

Meters—the Watch Dogs of Plant Operation

By ROBERT R FREDERICK
Plant Engineer, Sloane-Blabon Corp
Philadelphia, Pa.

MANAGERS OF MANY industrial plants are taking advantage of modern steam-engineering practice to obtain large savings in power-plant operation. They study closely methods of reducing steam and power costs and immediately investigate the cause of any increase. The fact is never lost sight of that the steam and power departments can be important sources of profit or loss.

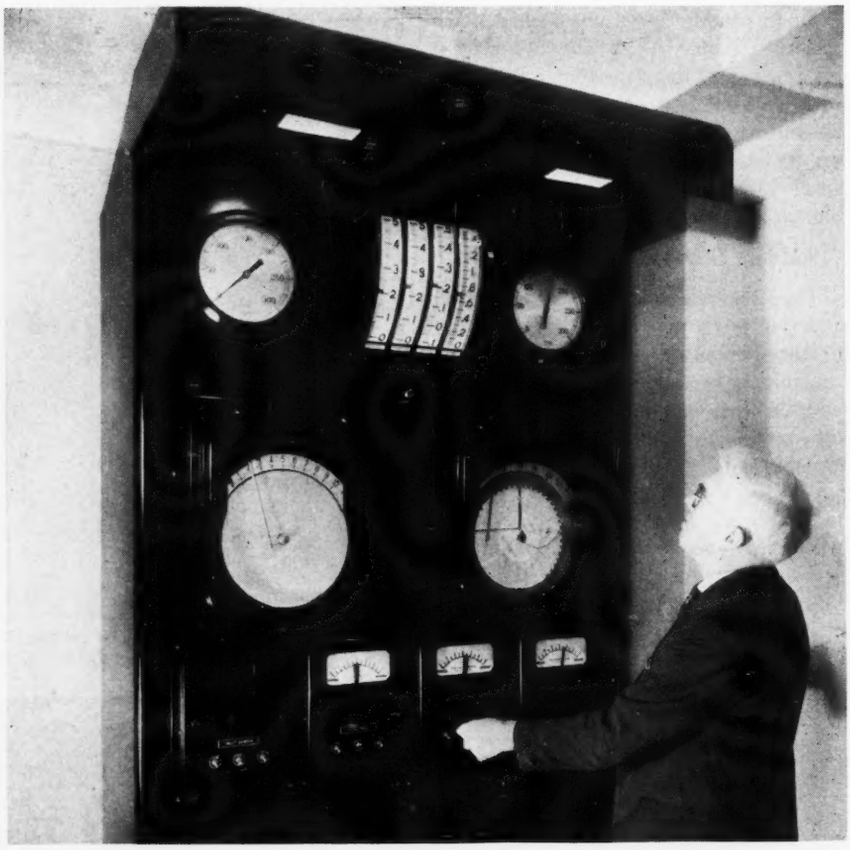
Before a plant can be operated intelligently, the engineers must have essential meters and instruments. Readings provide necessary data from which a daily check can be made of plant performance. If efficiency decreases, it can be detected immediately and corrected before large losses occur.

Meters Are Ever Alert

With records of all quantities before them, operators become highly skilled in interpreting plant performance and can therefore detect sources of loss and defects in plant equipment that would otherwise pass unnoticed, at least until a breakdown occurs. Meter records place responsibility for faulty operation; they are valuable as watch dogs, ever alert to prevent needless waste and encourage operators to improve performance. There are many other advantages, some of which will be mentioned later.

A knowledge of what goes into one end of the plant and what comes out at the other ranks well up at the head of the list of essential facts. Necessary to this knowledge is a method of weighing fuel to each boiler and flowmeters to record and integrate steam produced. Until we accurately know these two quantities, we cannot go very far in analyzing the factors affecting operating efficiency.

If we know amount of steam produced and weight of coal burned, it is a simple matter to keep a continuous record of fuel cost per 1000 lb of steam produced. The economic value of different grades of fuel can be studied and one selected that gives the lowest steam cost. Such studies, based on accurate meter records, frequently reveal possibilities for large savings in fuel cost.



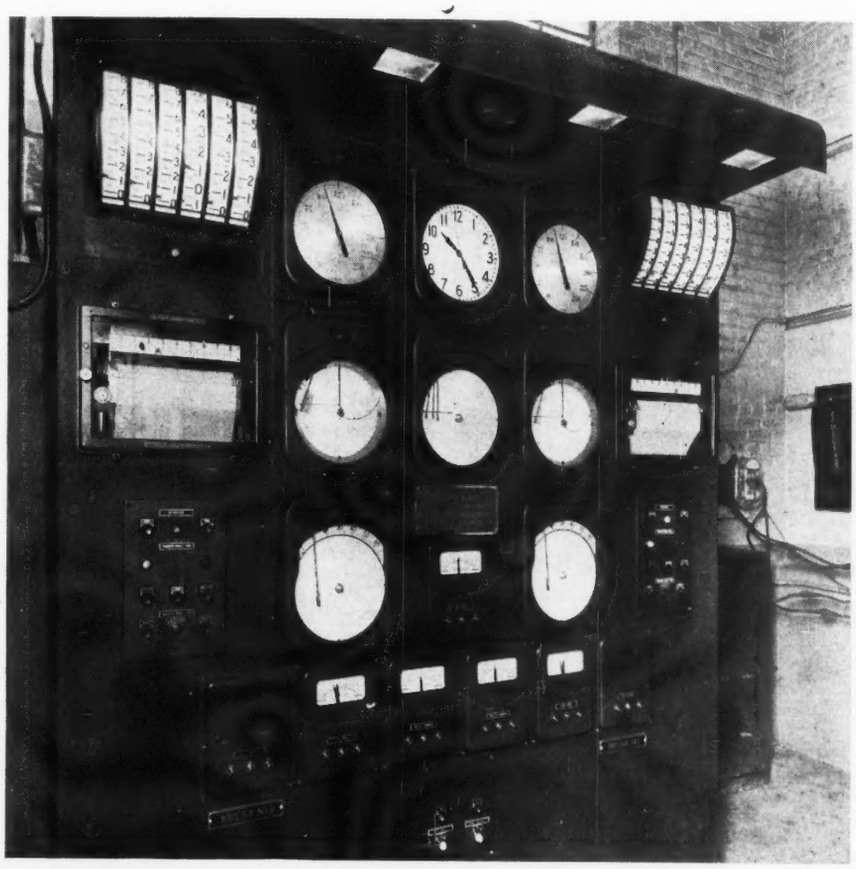
On this panel board are centered all meters and control equipment necessary to operate the boilers under practical test conditions at all times

Flowmeters on lines to major steam-consuming departments and equipment are a good investment. They permit charging each accurately for steam used. Cost of operation can be more closely applied to unit of product made. Comparison of designs of equipment for improved efficiency can be made and designs to accomplish this end can be adopted. Uneconomical practices are easily detected and records of quantities are available for use in designing plant extensions. Metering equipment changes slip-shod practices to sound business methods based on an accurate knowledge of facts. What applies to the metering of steam to different departments and equipment holds equally true

for power and frequently for water, gas and air.

Flue-gas temperature is a measure of one of the largest losses from a boiler. Therefore, a recording thermometer to show temperature of this gas may well be ranked as an essential meter in every power plant. Leaky baffles and dirty or scale-laden boiler surfaces can cause large fuel losses. These may exist undetected for long periods unless a record of flue-gas temperatures is available. A record of feedwater temperature is another important item in efficient plant operation.

A CO_2 meter or other method of measuring quality of flue gas is essential to good operation. A draft gage to measure at least under-fire and furnace draft should be part of any boiler plant's arrangement of measuring devices.



With automatic combustion control and meters, plant performance is under continuous observation of the operator. Result is maximum economy

The meters mentioned are all necessary to any plant, but there are many other factors we should know for complete understanding of plant operation. How far it is economical to go in instrumentation depends upon the plant's design, type of equipment installed, size of plant and other factors.

For example, in one industrial boiler plant with two large boilers fired with blast-furnace gas and pulverized coal, a 12-point draft gage on each boiler measures draft at 12 points in the draft, puluverized-coal and gas systems. A temperature recorder shows temperature of flue gas entering the economizer, gas entering the air heater, gas leaving the air heater and air leaving the air heater. Another recorder shows temperature of water entering the economizer, water leaving the economizer, steam temperature at superheater outlet and feedwater flow to the boiler. A steam-flow air-flow meter and a water-level recorder are also provided for each boiler. A master recorder for the two boilers records steam pressure leaving the superheater and pressure in the gas main. Coal meters record weight of coal to each pulverizer. Pressure gages indicate boiler-drum pressure and feedwater pressure at the control valves and ammeters indicate current to each auxiliary-drive motor.

Another example is a small plant with two stoker-fired boilers. Metering equipment on each boiler includes a 6-point draft gage; a 4-point recording potentiometer, each point connected to three thermocouples, to obtain average air and gas temperatures at inlet and outlet of the air heater; a graphic meter to record steam pressure, feedwater pressure and temperature; a steam-flow meter, CO_2 recorder and a pressure gage. Lights indicate high and low coal level in the overhead coal bunker and high and low water level in the hot well. Coal is weighed to each boiler by an overhead weigh larry.

No mention has been made of meters on the steam-distribution lines in these plants, but as in the boiler plant, the record is complete so that any unnecessary losses can be detected immediately.

Automatic combustion control can be profitably applied to any boiler plant. How complete the system should be depends upon size of the plant. Automatic control, to a large degree, eliminates the human element in adjusting the combustion process. Load changes are immediately cared for and combustion efficiency maintained. Operators, relieved from the duties of manual control, can give attention to things that affect combustion efficiency and make slight adjustment to obtain most economical performance.

Automatic combustion control, like meters, properly applied and used, will pay for itself in a short time in reduced fuel costs. I know of one small plant where installation of automatic combustion control saved nearly $5000 per year in reduced fuel costs.

It is just as important that intelligent cost accounting be applied to steam and power generation as in the production departments. Every dollar saved in the power plant is equivalent to $10 sales income, estimating profits at 10%, and $20 if profits are only 5%. This is now recognized by the management of hundreds of plants and accounts for the vast amount of modernization of steam plants during the last few years.

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How Large Check Valves?

The size of stop-check valves should always be based on boiler capacity and not on size of existing boiler nozzles or piping. To determine the proper size for any boiler, calculate the number of pounds of steam the boiler will generate per hour at its nominal rating. Use a velocity of steam flow of 4000 ft per min and figure the size of the valve required from the following formula:

$$C = \frac{A \times B \times 2.4}{V}, \text{ in which}$$

C = area of pipe in sq in.
A = lb of steam per hr
B = volume in cu ft of 1 lb of steam at the given pressure
V = velocity in ft per min

—From Crane Co's "Valve World".

The ABC's of Feed Heating

By NORRIS D GOVE
Westinghouse Electric & Mfg Co

Why does a feed-heating turbine have a higher steam rate than a straight condensing unit? How much fuel can be saved by bleeding? Here are the answers, with typical calculations

THE IDEA OF HEATING FEEDWATER by bleed steam was born less than 20 years ago. In this relatively short time, practically all new condensing turbines have been provided with bleed points and operate on the regenerative cycle.

The practice has grown rapidly and the technique improved in each new application; operation has outrun text books. As a result there is little published elementary data helpful to men taking up these necessary calculations for the first time. This article is no more than a primer lesson and the author has drawn heavily on published material and experience of Kramer, Reynolds and Zetterquist.

The computations shown here apply to all cases of steam extraction from turbine stages or for mixed-pressure turbines that have steam entering the casing between stages. They can be extended readily to cover extraction-condensing and backpressure turbines or any other combination of turbine and process steam.

The illustrations all show the same turbine with various combinations of heaters, auxiliary steam, etc. In all combinations, the turbine operates at its full load of 10,000 kw on 400-lb (415-lb absolute) steam at 700 F and exhausts to a condenser that holds a constant 28.5-in. vacuum. Stage efficiency is taken as a uniform 80% applied to the heat drop for the initial entropy from the throttle to the exhaust. On this convenient basis, the condition of the steam at any point in its expansion within the turbine can be calculated and the internal load determined.

Straight Condensing

In Fig. 1, steam and heat rates for straight-condensing operation are calculated. With 80% stage efficiency and 96% mechanical efficiency, the net Rankine-cycle efficiency is the product of the two, or 76.8%. Initial entropy (s) is 1.636 and the Btu per lb of steam available for conversion into work between throttle and exhaust is found to be 462.5. With 80% stage efficiency, 370 Btu per lb is converted to work, 991.5 goes to the condenser.

Since it takes 3412 Btu of work to make a kwhr and the over-all efficiency including mechanical and electrical losses is 76.8%, the steam rate is 9.606 lb per kwhr. Every lb of steam supplied to the turbine has 1361.5 Btu and 60 Btu per lb are returned to the boiler. The heat rate is 12,502 Btu per kwhr.

Heat rate is the readiest method of comparing turbines, since it is applicable to any cycle. Furthermore, it is the best basis of estimating plant heat rate and fuel cost of power.

For instance, if we assume 85% boiler efficiency and 5% auxiliary-power requirements, the plant heat rate with the above turbine becomes:

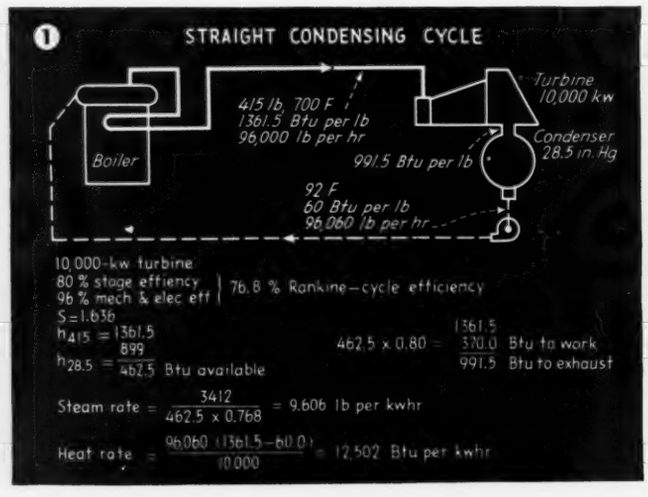
$$\frac{12502}{0.85 \times 0.95} = 15{,}500 \text{ Btu per kwhr}$$

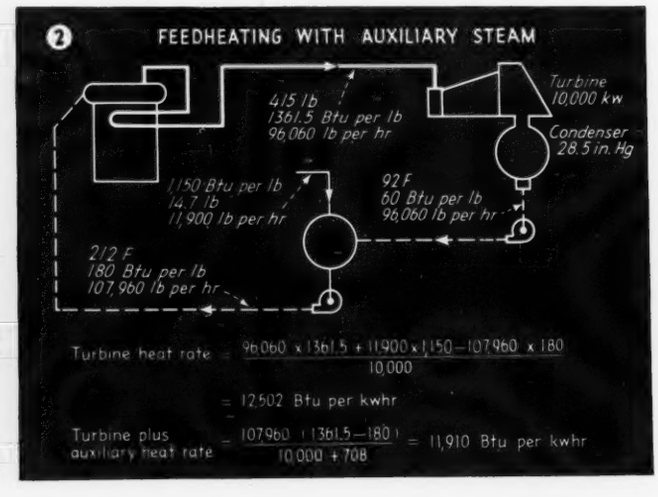
Furthermore, if we assume that coal of 13,000 Btu per lb costs $4 per ton, or 2 mills per lb, the fuel rate is:

$$\frac{15{,}500}{13{,}000} = 1{,}193 \text{ lb per kwhr}$$

and the fuel cost is:

$1.193 \times 2 = 2.386$ mills per kwhr.


1 STRAIGHT CONDENSING CYCLE
Turbine 10,000 kw
415 lb, 700 F
1361.5 Btu per lb
96,000 lb per hr
Boiler
991.5 Btu per lb
Condenser 28.5 in. Hg
92 F
60 Btu per lb
96,060 lb per hr
10,000-kw turbine
80 % stage effiency
96 % mech & elec eff
76.8 % Rankine-cycle efficiency
S=1.636
h415 = 1361.5
h28.5 = 899
462.5 Btu available
462.5 x 0.80 = 370.0 Btu to work
991.5 Btu to exhaust
Steam rate = 3412 / 462.5 x 0.768 = 9.606 lb per kwhr
Heat rate = 96060 (1361.5−60.0) / 10,000 = 12,502 Btu per kwhr


2 FEEDHEATING WITH AUXILIARY STEAM
Turbine 10,000 kw
415 lb
1361.5 Btu per lb
96,060 lb per hr
Condenser 28.5 in. Hg
1150 Btu per lb
14.7 lb
11,900 lb per hr
92 F
60 Btu per lb
96,060 lb per hr
212 F
180 Btu per lb
107,960 lb per hr
Turbine heat rate = 96060 x 1361.5 + 11900 x 1150 − 107960 x 180 / 10,000
= 12,502 Btu per kwhr
Turbine plus auxiliary heat rate = 107960 (1361.5−180) / 10,000 + 708 = 11,910 Btu per kwhr

The heat rate of this turbine was calculated to be 12,502 Btu per kwhr. This means that for every kwhr of power delivered to the switchboard, the boiler had to produce and deliver to the turbine, 12,502 Btu net. This was in the form of steam with credit allowed for the small amount of heat returned to the boiler in the condensate. This heat used per kwhr manufactured didn't just disappear but was disposed as follows:

Heat transformed into kwhr at the switchboard	3,412 Btu
Heat transformed into power but changed back into heat again and wasted as mechanical and electrical losses—4% of the gross power	142 Btu
Heat lost in condenser and carried away by circulating water—9.606 × (991.5 —60)	8,948 Btu
Total	12,502 Btu

The first figure is the heat equivalent of one kwhr and is, of course, irreducible. The second is a comparatively small item, gradually growing smaller with improvements in prime movers. A large part of this item is recoverable in generator air coolers and oil coolers using condensate as the cooling medium although many engineers feel that the added cost for oversize coolers is not justified by the saving. The third figure, more than 70% of the total, is the one to which engineers give particular attention. Regenerative feed heating reduces this loss as will be shown later.

Referring again to the tabulation above, and remembering that efficiency is the ratio of output over input, the thermal efficiency of this turbine is

$$\frac{3412}{12{,}502} = 27.3\%.$$

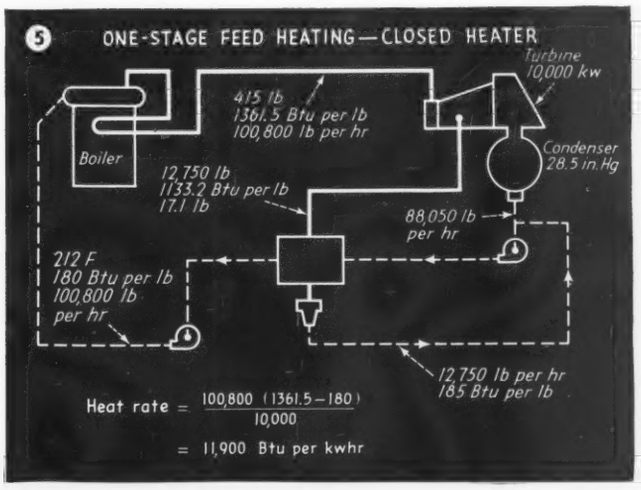
Pumping cold feedwater into a boiler not only imposes serious temperature strains on the boiler but also is comparatively inefficient. A common early method of feedwater heating (not regenerative feed heating) is shown in Fig. 2. In this system, exhaust steam from auxiliaries is led into a tank where it mingles with the condensate from the main turbine, raising feedwater temperature to about 212 F. From this tank the resulting mixture is pumped into the boiler.

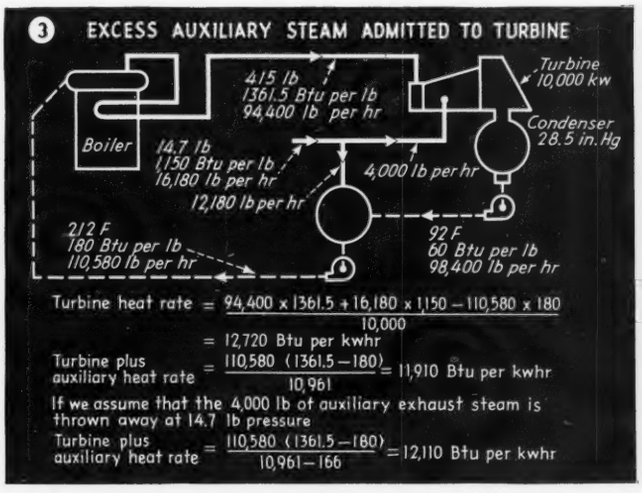
It will be seen from the illustration that the *turbine heat rate* is unchanged by adding this heater, since the same amount of steam is supplied to it and condensed as in Fig. 1. If we include the auxiliaries, however, the picture changes. The heat rate for the gross output of turbine and auxiliaries drops to 11,910 Btu per kwhr for 10,708 kw. Compared with this, the turbine of Fig. 1 must have its output increased to about 10,708 kw at 12,502 Btu per kwhr for motor-driven auxiliaries, or if, for purposes of illustration, we assume the auxiliaries are driven by condensing turbines of the same efficiency as the main unit, the heat rate for the gross output is still 12,502 Btu per kwhr.

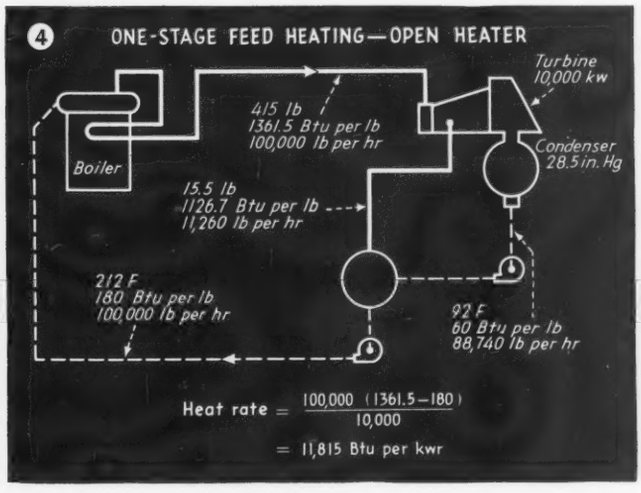
The amount of auxiliary-exhaust steam that can be condensed in the heater of Fig. 2 is definitely limited by the amount and temperature rise of the main condensate. In many plants of this style, there is an excess of auxiliary exhaust steam at times. This excess can be led into the main turbine through a suitable opening to produce some power, permitting a reduction in the amount of high-pressure steam used for the same output.

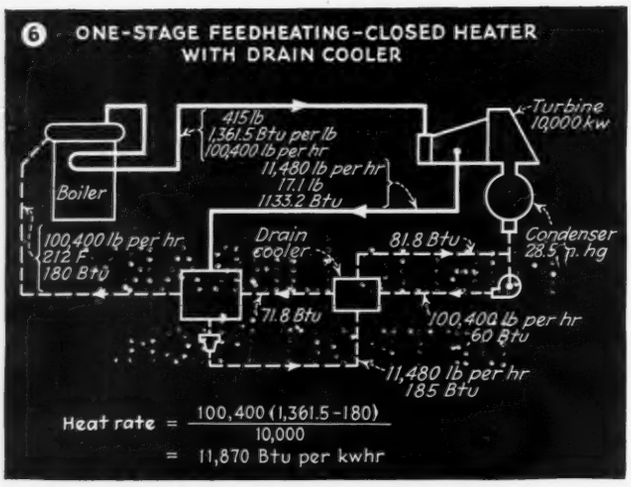
Many of the turbines of 20 years ago were built with this atmospheric inlet and equipped with a control valve known as a *constant-pressure* or *spill-over* valve. Both names are eminently descriptive since the function of the valve is to maintain a constant pressure in the auxiliary-exhaust system and to permit excess steam to spill over into the main turbine. The arrangement and heat balance is typified in Fig. 3 where it will be seen that the only benefit is to prevent waste of low-pressure steam.

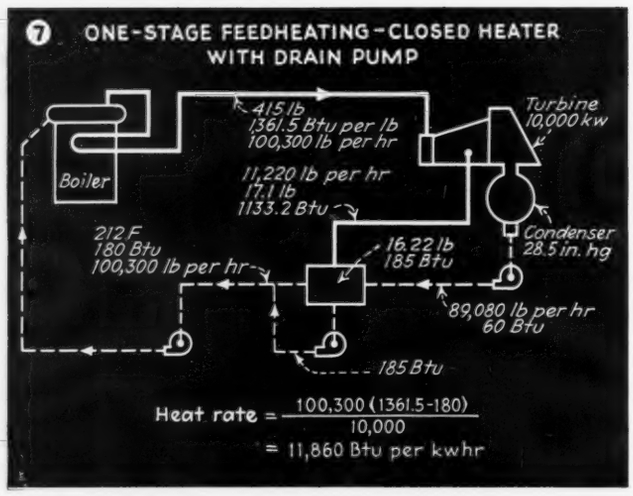
Simple single-stage regenerative feed heating with an open heater is shown in Fig. 4. Since the same turbine is used as in Fig. 1, a direct comparison shows

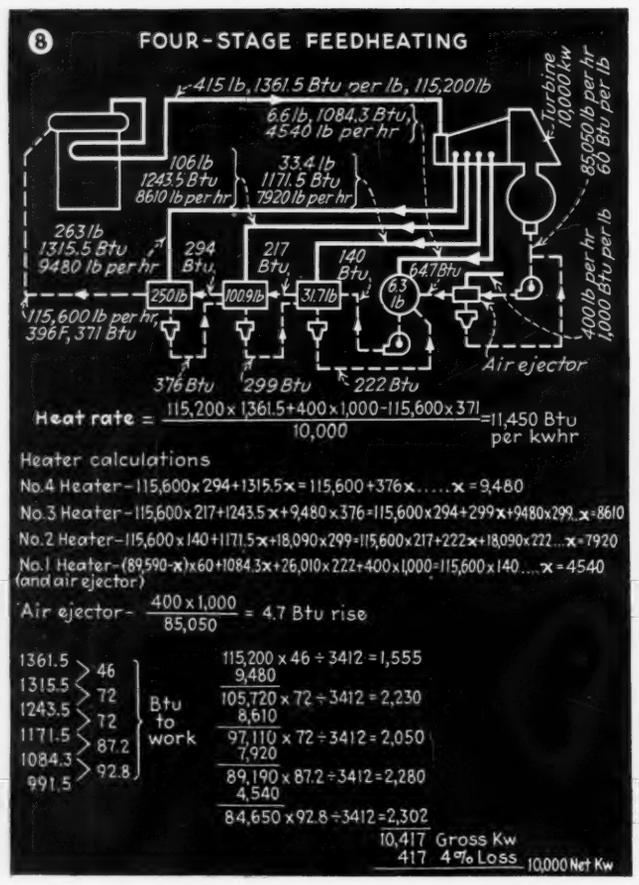

5 ONE-STAGE FEED HEATING—CLOSED HEATER
Turbine 10,000 kw
415 lb 1361.5 Btu per lb 100,800 lb per hr
Boiler
Condenser 28.5 in. Hg
12,750 lb 1133.2 Btu per lb 17.1 lb
88,050 lb per hr
212 F 180 Btu per lb 100,800 lb per hr
12,750 lb per hr 185 Btu per lb
Heat rate = 100,800 (1361.5 − 180) / 10,000
= 11,900 Btu per kwhr

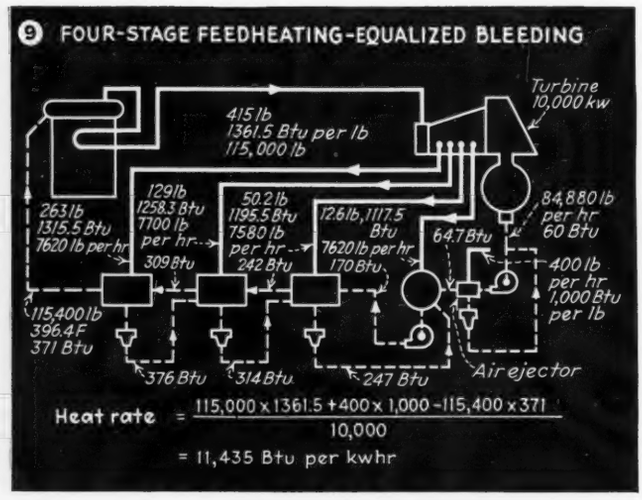

3 EXCESS AUXILIARY STEAM ADMITTED TO TURBINE
Turbine 10,000 kw
415 lb 1361.5 Btu per lb 94,400 lb per hr
Boiler
Condenser 28.5 in. Hg
14.7 lb 1,150 Btu per lb 16,180 lb per hr
4,000 lb per hr
12,180 lb per hr
212 F 180 Btu per lb 110,580 lb per hr
92 F 60 Btu per lb 98,400 lb per hr
Turbine heat rate = (94,400 × 1361.5 + 16,180 × 1,150 − 110,580 × 180) / 10,000
= 12,720 Btu per kwhr
Turbine plus auxiliary heat rate = 110,580 (1361.5 − 180) / 10,961 = 11,910 Btu per kwhr
If we assume that the 4,000 lb of auxiliary exhaust steam is thrown away at 14.7 lb pressure
Turbine plus auxiliary heat rate = 110,580 (1361.5 − 180) / 10,961 − 166 = 12,110 Btu per kwhr


4 ONE-STAGE FEED HEATING—OPEN HEATER
Turbine 10,000 kw
415 lb 1361.5 Btu per lb 100,000 lb per hr
Boiler
Condenser 28.5 in. Hg
15.5 lb 1126.7 Btu per lb 11,260 lb per hr
212 F 180 Btu per lb 100,000 lb per hr
92 F 60 Btu per lb 88,740 lb per hr
Heat rate = 100,000 (1361.5 − 180) / 10,000
= 11,815 Btu per kwr









that, with feed heating, a lesser quantity of steam passes through the lower stages of the turbine to the condenser. This is offset by the larger quantity passing through upper stages so that the total load remains the same. The reduction in turbine heat rate is a direct reflection of the reduction in heat carried away by the circulating water.

The amount of steam bled depends on the amount of feedwater and temperature rise of the feedwater. It is calculated by setting up a simple algebraic equation which states that the heat entering the heater equals the heat leaving the heater. In Fig. 4, for example, let X equal the amount of steam bled, then:

$1126.7X + (100{,}000 - X) \times 60 = 100{,}000 \times 180$ and $X = 11{,}260$ lb per hr

Since the heat content or enthalpy of the steam is expressed in Btu's, we must be careful to use the heat content of the feedwater and not its temperature in setting up all our equations.

Deaerating Heater

The heater of Fig. 4 is known as an *open, contact* or *deaerating* heater. It is characterized by the bled steam mingling with the feedwater. This intimate contact drives off dissolved oxygen which would otherwise corrode boilers. The oxygen is vented to the condenser through a connection (not shown).

Another characteristic of the contact heater is that the terminal difference between saturated temperature, corresponding to the pressure of the steam in the heater and the temperature of outgoing feedwater, is practically zero.

It should be noted that, while the contact heater is often loosely called an *open* heater, it need not be, in fact, open to atmosphere. The heater is often entirely closed and may operate under

either pressure or vacuum or swing from one to the other with changes in load. A special arrangement, believed by some to promote better deaeration, is to maintain constant pressure in the heater by admitting steam from turbine stages through reducing valves. While this may make for more efficient deaeration, the degradation of the bled steam makes the arrangement thermally less efficient.

Figs. 5, 6, and 7 show various arrangements of single-stage heating to the same final feed temperature but using a closed heater. Feedwater passes through tubes while the bled steam circulates around them and is condensed. The drain water from the heater must be trapped into a region of lower pressure (in this case the condenser) with an attendant wastage of heat or it must be pumped into the feedwater line which requires a pump and some power consumption. With multi-stage heating, the comparison is not so adverse to the closed heater since the open heater requires a pump following every heater. In consequence, more closed heaters are used than open.

Fig. 8 shows a typical arrangement of closed and open heaters for 4-stage feed heating with the condensate heated to 396.4 F. The three upper heaters are closed with their condensate flashed successively into the next lower heater. The lowest-pressure heater is a deaerating type. An air ejector with its inter and after condenser is represented schematically.

As an approximation, the system is charged with 1000 Btu for every lb of air-ejector steam. The error from the use of this convention is insignificant and the method is widely used. Amount of steam wasted to the condenser is considerably reduced below that given in previous examples, which explains the lower heat rate. The heater equations are shown completely worked out.

In Fig. 8, the bleed pressures were taken at random, which resulted in unequal amounts of steam to the several heaters. In Fig. 9, otherwise the same, more careful selection of pressures produces practically equal flows. A comparison of the two arrangements indicates, within limits of slide-rule accuracy, the very slight improvement obtained from equalized bleeding and points to the conclusion that not much expense should be incurred in attempts to obtain it. This is further borne out by the obvious fact that bleed flows can only be equal at one load. As load is decreased or vacuum dropped, the temperature rise through the low-pressure heater lessens rapidly and steam flow to this heater decreases more rapidly than to the others.

Fig. 10 is a partial sketch indicating that the heat balance of Fig. 8 is modified by the use of a desuperheating heater in the high-pressure bleed line. This is a heat exchanger which removes superheat from the bled steam by transferring heat to the feedwater, raising the final feed temperature 9.4 F.

While shown here as a separate element, the heat exchanger can be combined with the main high-pressure heater by a system of baffling so that the latter can be considered as having a negative terminal difference and is superior in this respect to any ordinary contact heater.

Terminal difference of heaters can be overstressed. Actually, a 10-F excess terminal difference in any heater may increase the over-all heat rate 0.1 to 0.2%. In regions where fuel is cheap, it is easily possible that enough fixed-charge saving can be made by buying smaller, high-terminal-difference heaters to offset the higher fuel cost which results from their use. This is a problem to be settled for each plant.

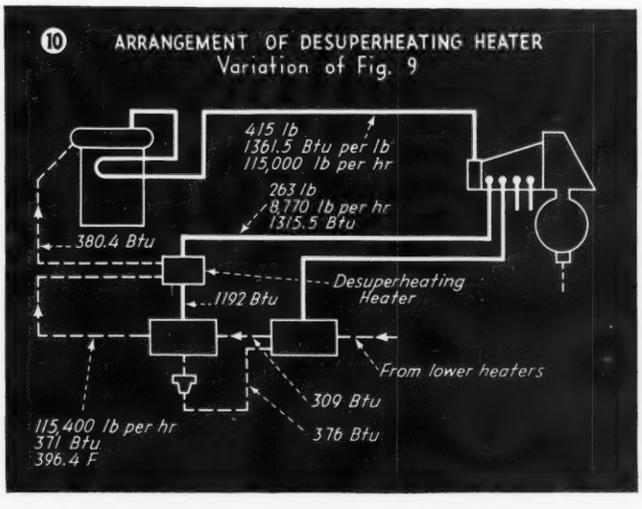
Common practice in making turbine guarantees is to assume a pressure drop from turbine to heater of 5% of the absolute pressure and a 5-F terminal difference. On test, correction can be made for a greater or lesser terminal difference. The correction is based on the fact that, for small changes in steam flow through the different stages of the turbine, the change in stage efficiency is inappreciable. Consequently, the condition curve of the steam is considered as unvarying at any load and bleeder flows, heat rates are calculated for the actual terminal difference. The comparison between this heat rate and that guaranteed gives the correction to be applied for terminal difference.

Preparing Correction Curves

It is convenient before a test to prepare curves for each heater showing the increase in heat rate for say 10-F excess terminal difference. The effect of excess pressure drop may be conveniently included in the same curves by redefining terminal difference (for the purposes of the test correction) as the difference between the saturated temperature corresponding to the pressure of the steam *in the turbine* and temperature of outgoing feedwater. This expedient reduces the labor of preparing and applying these corrections which either manufacturer or buyer can do by a perfectly mechanical process. It is, however, necessary to use long-hand calculations or a calculating machine on both the basic guarantee and the correction, because the slide rule is not accurate enough to show such small differences.

While this discussion has been kept quite elementary, it should be remembered that those who master even the few fundamentals presented have knowledge not conceived of 20 years ago.

With this start, comparative studies can be made of various feed-heating arrangements. The method is simple. Assume certain stage efficiencies such as the 80% in the turbine mentioned here or take the efficiency from an actual turbine guarantee. For convenience, plot the pressures and heat contents on a Mollier chart or even on cross-section paper and connect the points by lines, forming a condition curve. Then set up the heat-balance problem, solve it, and calculate the heat rate. Repeat the process, varying the factor under consideration and plot results. This will yield a curve which may throw considerable light on the problem at hand and may even suggest new equipment arrangements.



Here are the things that insure long and reliable service from diaphragm-motor-operated valves

Out-Smarting Trouble on Motor-Diaphragm Valves

By E H HAMMOND
Chief Engineer

American S & B Instrument Division
Manning, Maxwell & Moore, Inc

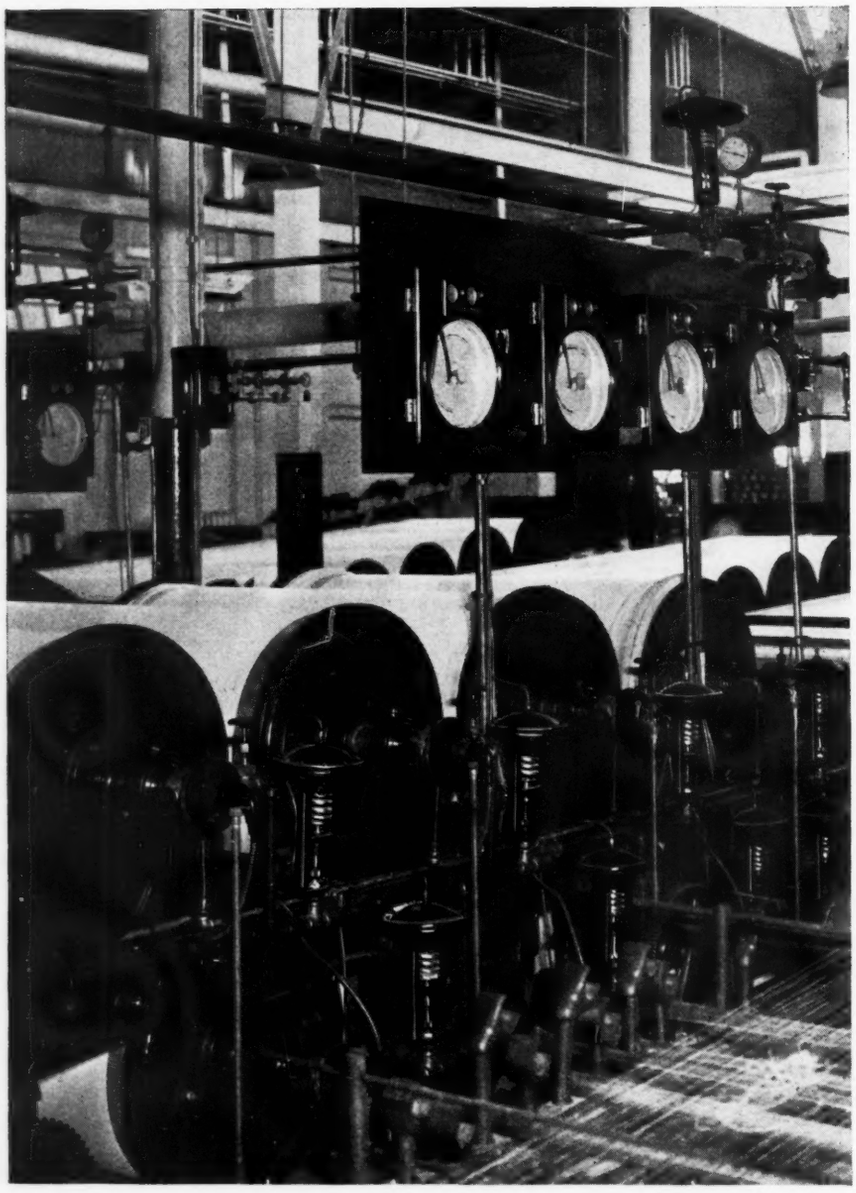


Fig. 1—Single-seated, direct-acting diaphragm-motor-operated valves control flow of steam to inlets of 7-can rayon slasher in a textile mill

FOR ACCURATE automatic control of steam, gas, water and other liquids, several designs of diaphragm-motor-operated valves are used. These valves are actuated by fluid pressure applied to a flexible diaphragm, motion of which is opposed by helical springs, Figs. 3 and 4. Uusually, these valves are operated by compressed air from a pilot-actuated regulator, or an air-operated instrument controller. When properly selected and installed, these valves give long and reliable service, but diaphragms, packing and trim may need occasional attention.

Diaphragms

Diaphragms are usually made of natural or artificial rubber with duck or linen inserts. They may be moulded to a predetermined shape to give maximum flexibility. Ordinary flat composition diaphragms must stretch as they deflect. Packing friction, off-balance load acting on the valve disk, and amount that the diaphragm must deflect determine its diameter.

A diaphragm is not likely to fail unless subjected to severe heat, oil, gas, or fluids which deteriorate the rubber. On these applications, use a synthetic rubber, such as Neoprene, or if the valve travel is small, use a metal diaphragm if possible.

When the valve is installed upside-down, with the diaphragm below, on hot-oil, chemical, or steam service, the drip from the stuffing box is likely to injure the diaphragm. Here, install the valve erect. If this is not possible, install a drip pan to protect the diaphragm. Keep spare diaphragms in stock; then it is only a few minutes job to replace a failure. Otherwise, an expensive shutdown may be the result

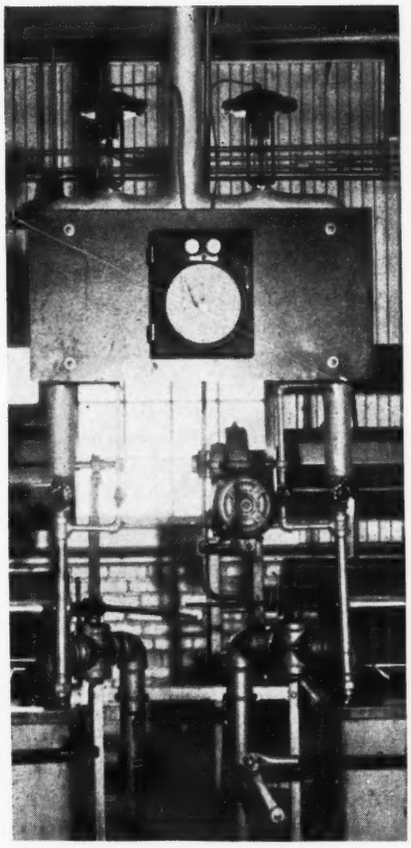


Fig. 2—Diaphragm-motor-operated valves on steam lines to rayon die becks

of waiting for a replacement. If steam is likely to come in contact with the diaphragm, seal it with water.

Packing Glands

The packing gland is more likely to leak or give trouble on a diaphragm-motor valve than on an ordinary hand valve. On a diaphragm-motor valve, the stem slides almost continually through the packing. This action tends to wear the stem and destroy the packing. Do not make the packing so tight as to cause undue friction. A lubricated stuffing box, Figs. 3 and 4, helps on hot services. If temperature of the fluid passing through the valve is above 500 F, an air-cooled, lubricated stuffing box is recommended, Fig. 4. Sometimes the valve handles fluids of such a nature that stuffing-box leakage constitutes a hazard to life and property. Here, if possible, use a so-called packless stuffing box, consisting of a bellows seal. Whether a bellows can be used depends on the pressure, temperature, valve travel, and the corrosive action of the fluid on the bellows.

Valve trim presents a real maintenance problem. The largest single cause of seat and disk wear is too large a valve. Chattering and wire drawing of an over-sized valve quickly destroys seats and disks of almost any material. Frequently, valves handle fluids which corrode or erode the trim. A trim should be selected that will best resist corrosive action of the fluid. An alloy highly resistant to corrosion from one liquid may not be equally resistant to some other liquid. Follow the manufacturer's recommendations as to the best trim to use.

Install diaphragm-motor valves in the straight run of a bypass, with a shut-off valve on each side, and a throttling valve in the bypass. The shut-off valves preferably should be gate or plug type to reduce pressure drop and turbulence. Such an installation makes it possible to remove the diaphragm-motor valve for repair without shutting down the line.

No definite instructions can be given on procedure for replacing valve seats and disks. These vary somewhat with the type and make of valve. Where possible, remove the valve from the line and take it to a shop where adequate tools are available. When a valve has been in service for some time, it may be necessary to cut the seat rings out of the body. Sometimes mildly heating the rings with a torch will loosen them. Be careful not to ruin the threads in the valve body or you may have to do a difficult threading job before you can install the ring.

Double-seated valves must be ground in carefully to avoid tearing or marring the seat or disk. Establish both seats at the same time; if one seat only contacts, use grinding compound on that seat, with just a trace on the other seat, until both are established uniformly. No double-seated valve with metal trim can be made to dead-end under very high pressure, nor at low pressure for any length of time. A double-ported valve is for regulating and not dead-end service, and should not be used where safety demands an absolutely tight shut-off.

Most diaphragm-motor-operated valves have screwed or pressed-in seat rings which can be renewed when worn or corroded. To prevent leakage, the seats are set up very tight at the factory, and it usually is a shop or factory repair job to replace the rings, especially on the double-ported type. This, however, is cheaper than replacing the entire body, and the separate seat construction permits using seat material different from the body.

Photograph, Fig. 3, is Fisher Governor Co. Fig. 4 is Mason Neilan Regulator Co.

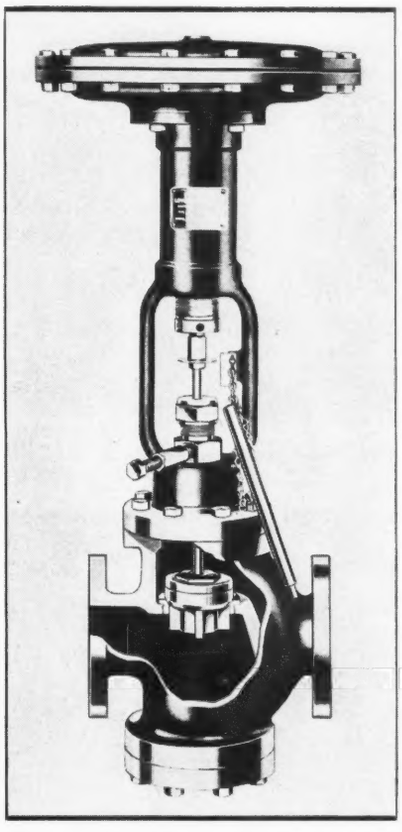


Fig. 3—Single-seated, direct-acting, diaphragm-motor valve with quick-opening valve plug and grease-sealed stuffing box

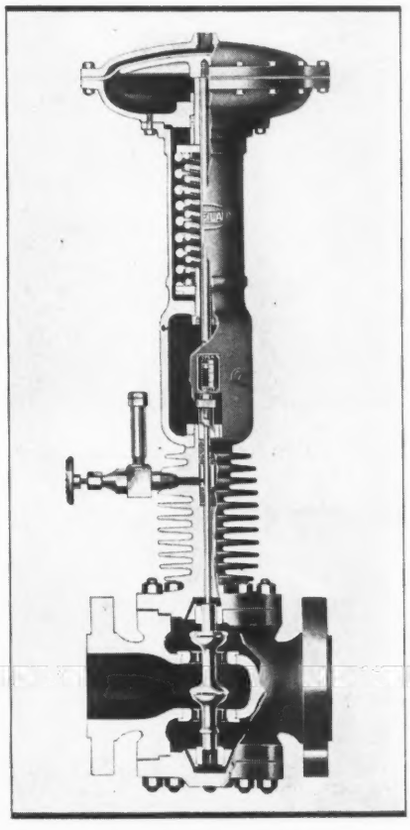
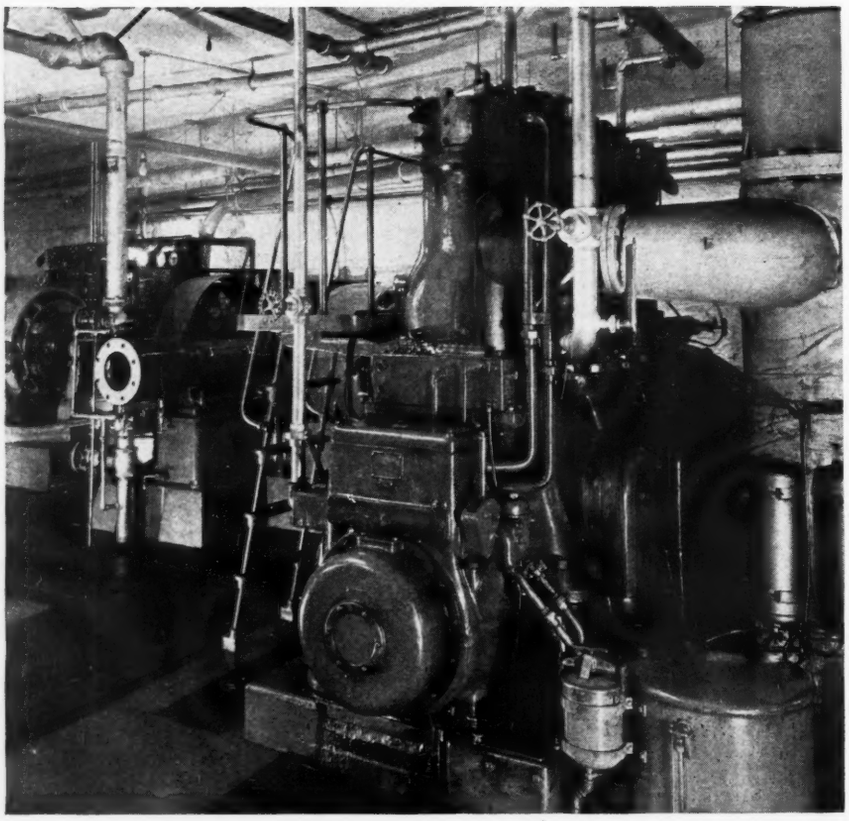
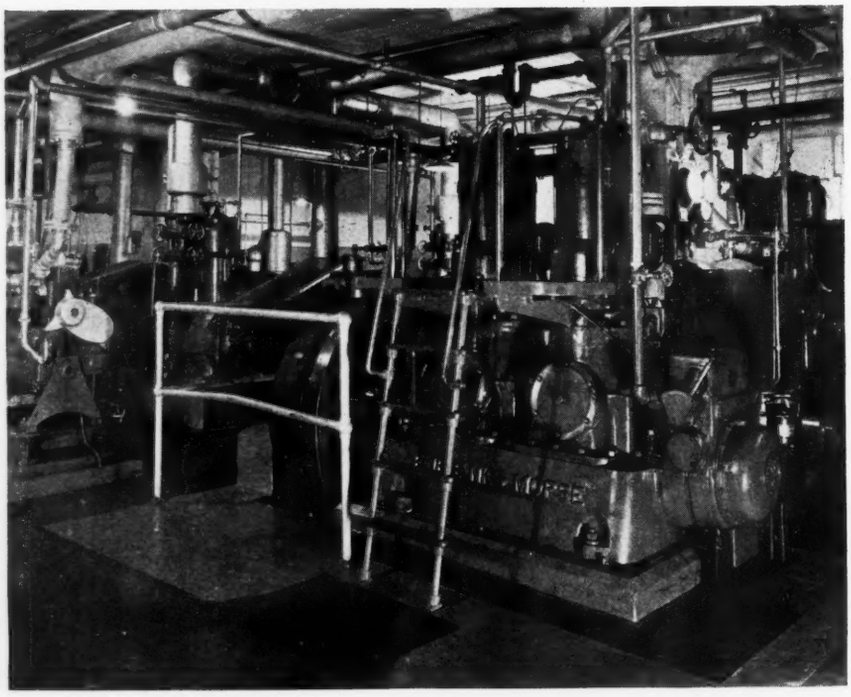


Fig. 4—Direct-acting, diaphragm-motor valve with parabolic valve plug, grease seal and air-cooled stuffing box

No Btu's Lost in



Two steam-engine-driven and one diesel-driven generator handle dc load



These diesels make an ideal drive for refrigerating compressors

BY INTELLIGENTLY EXPLOITING the possibilities of teamed diesel and steam power, with full heat recovery, the engineers of Borden's Farm Products turned an inefficient power plant at the Willow Brook Dairy, Mt. Vernon, N. Y., into a money-saver. Making best possible use of existing equipment kept cost of the 5-year rehabilitation program at a sensible minimum.

When Borden's took over in 1935, Willow Brook had a combined plant, consisting of: a 165-hp, 3-cyl, 2-cycle, Fairbanks-Morse diesel driving a 100-kv, 115-volt, direct-connected dc generator, used principally for charging electric-truck batteries; a 75-hp, 2-cyl, 2-cycle, 300-rpm diesel (also Fairbanks Morse) belted to a 10x10-in., single-acting, vertical York ammonia compressor; a horizontal steam-driven ammonia compressor; two 11x10-in., 300-rpm Troy steam engines direct connected to 50-kw, 115-volt, Sprague dc generators; and a 7x8 in., 350-rpm Troy engine driving a 15-kw Sprague dc machine. Three Godfrey Keeler hrt boilers (2000 sq ft each), fired by steam-atomizing burners, supplied saturated steam at 125 lb to prime movers and to water heating and process uses.

Power Services

Power services supplied at this dairy include current for conveyors, handling equipment, bottling machines, general lighting, and battery charging for electric delivery trucks; high-pressure steam for bottle washing; low-pressure steam for building and hot-water heating; hot water for pasteurization, washing and sterilizing; and refrigeration for milk cooling, storage, and manufacture of Flakice.

In rehabilitating this plant, Borden engineers (under direction of E J Lockwood, Gen'l Engr), set down certain general plans of development and then worked them out gradually. The basic program included progressive elimination of dc generation except for battery charging, expansion of plant capacity, continuation of direct diesel drive for refrigeration compressors, and, most important of all, increasing plant efficiency by utilizing waste heat to meet most of process needs.

Dieselized Dairy

Unusually complete heat recovery from diesel and steam engines working together supplies hot-water needs and cuts cost of power services at Borden's Willow Brook plant

While changes were being made in the power plant, motors in the dairy were being converted to ac and new equipment was purchased on this basis. In addition, some processes formerly taking steam were adapted to use hot water, since the heat-recovery system planned would supply ample quantities of 200-F water.

Steps in Modernization

The first actual step in revamping the power plant was to scrap the old steam-driven compressor and the small engine-driven generator. Adding two 60-hp, 6-cyl, 1000-rpm, 4⅞x6-in. Cummins diesels V-belted to 8x8-in. York single-acting, vertical compressors took care of needed expansion of refrigerating capacity. To handle ac load created by changeovers in the dairy, two 10x10-in., 300-rpm, Erie-Ball engines direct-connected to 45-kva Burke alternators were transferred from another plant.

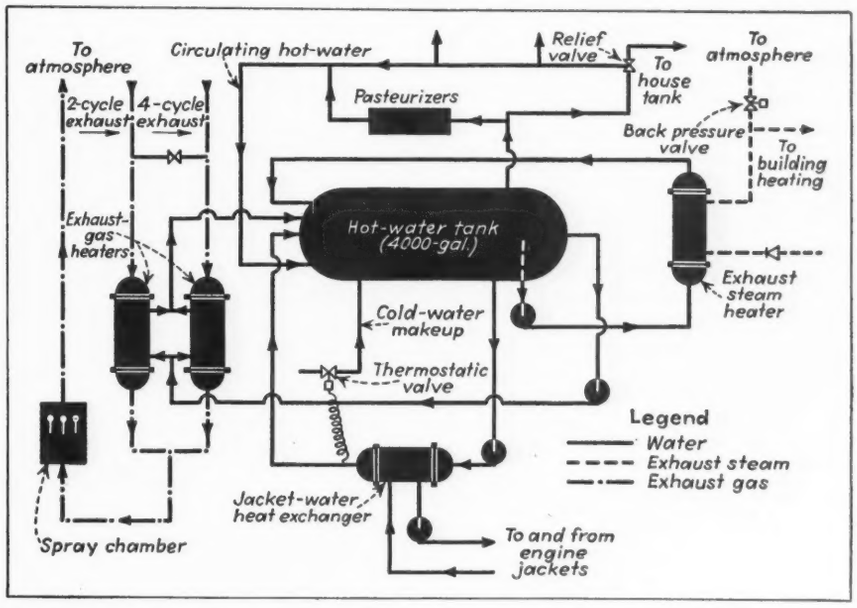
The company also purchased two 72-hp, 6-cyl, 1200-rpm, 4⅞x6-in., Cummins diesels driving 62.5 kva, 220-volt, 3-phase, 60-cycle generators. These changes brought plant capacity to 125 kva in ac diesel-generators, 90 kva in ac steam-generators, 110-kw in dc diesel-generators, 100 kw in dc steam-generators, and 195 hp in diesel-driven refrigeration.

Diesel Accessories

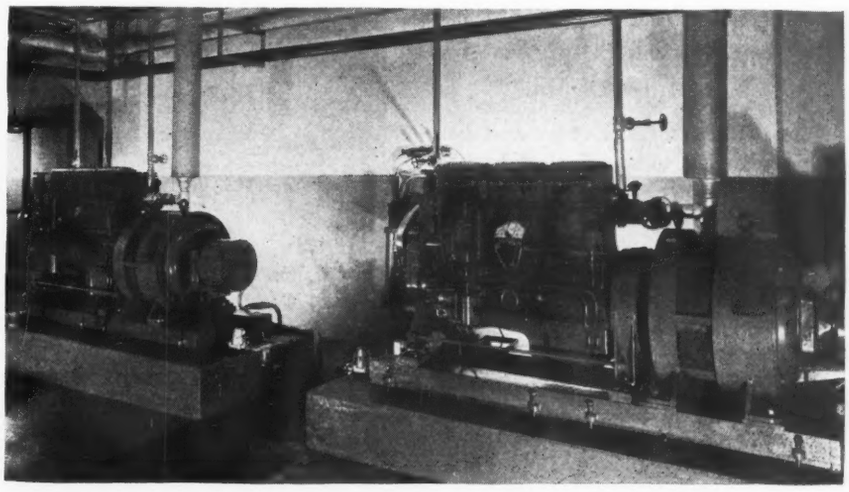
Two 10,000-gal. tanks, installed under ramps in the front of the building, hold the fuel-oil supply; one handles Bunker C for the boilers, the other No. 2 for the engines. Filters clean oil supply to the engines. On the Cummins engines, Protectomotor units filter intake air; the Fairbanks Morse diesels have built-in screens. Other engine accessories include Briggs clarifiers in the Fairbanks Morse lube-oil circuits and Skinner units on the Cummins machines.

The 3-way heat recovery system devised for this plant picks up Btu's from the diesel-jacket water and exhaust, and from the steam-engine exhaust. The diagram shows the layout, which incorporates some unusual features. Heart of the system is a 4,000-gal. storage tank to which all lines connect. Both water-using and water-heating circuits are arranged for continuous circulation. Hot water, drawn off at the top of the tank, goes to the plant distribution system; part goes to pasteurization units and is returned to the system at lower temperature; of the part that goes to the plant, some is lost, so that cold makeup water must be added at the tank.

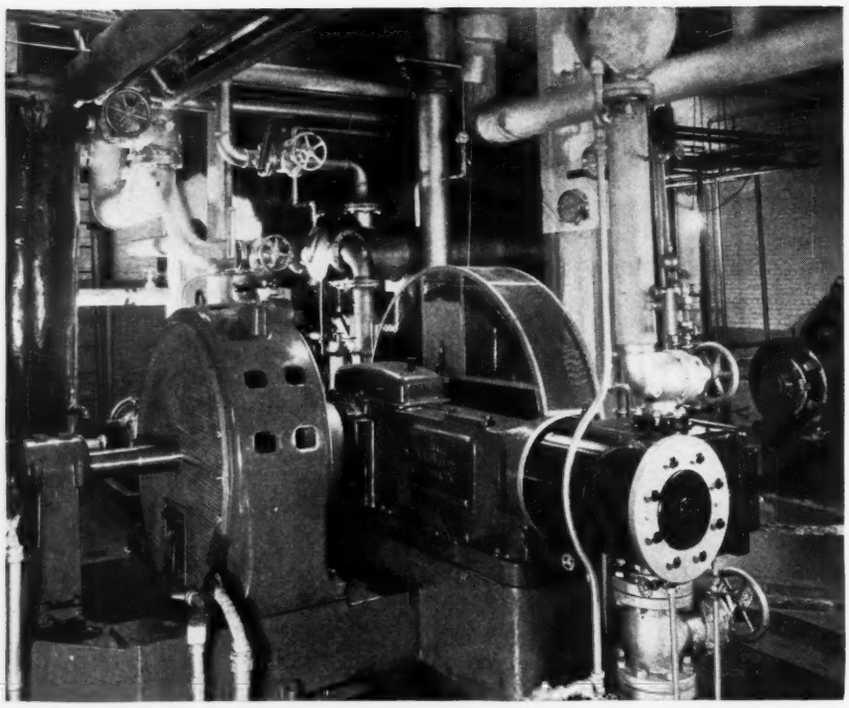
Particular interest attaches to the way water-heating circuits are connected so that low- and high-level heat work to best advantage. Jacket water represents the lowest heat level, of course; water to be heated in the Ross jacket-water heat exchanger comes from the bottom of the tank where temperature is lowest. This heater discharges into the tank at about halfway level. Water for the high-level exchangers (using steam-engine and diesel exhaust) leaves the tank at this point and returns near the top. In



Hook-up for 3-way Btu recovery (diesel jackets and exhaust; steam-engine exhaust) shows how high- and low-level heat is used to best advantage



Bulk of ac load is handled by these two 72-hp, 1200-rpm diesel-generators



One of two steam-engine-driven ac generating sets; heat recovery system in background

effect, there are two tanks; in one, cold water is heated to an intermediate temperature, in the other it is raised from the intermediate to the final temperature.

In the steam-heating circuit, exhaust from the four engines (totalling about 350 hp) flows through a Reilly heater and out to the building heating system. A backpressure valve controls flow to atmosphere.

About 500 hp of diesels exhaust through the two Sims exhaust-gas heaters. Piping is arranged so that 2-cycle units, with lower gas temperature (approx 450 F) discharge into one heater and the 4-cycle units (approx 650 F) into the other. A bypass permits mixing the exhaust from the two systems. Gas passes from the heaters to a steel muffling chamber, arranged with water sprays to cool the gas and reduce its volume before discharge to the stack.

Hot-Water Demand

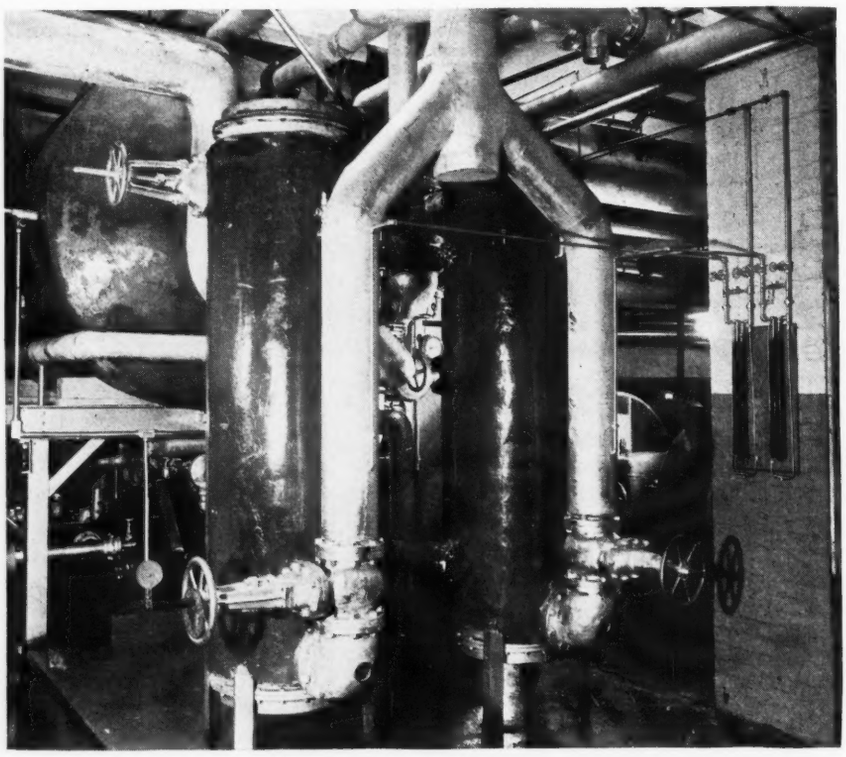
At present, there isn't enough hot-water demand to absorb full heating capacity of the recovery system. To keep engine temperatures at the desired point, a thermostatic element in the jacket-water-exchanger outlet controls a valve in the cold-water makeup line, admitting more as needed. This means, of course, that water supplied to the tank may exceed draw-off at times. To take care of this, a relief valve in the hot-water discharge line from the tank opens when pressure builds up and allows water to flow to the house tanks.

Further changes in dairy operations will increase hot-water load to a point where practically all the usable heat in the engine exhausts is put to profitable use. Borden engineers figure that by cooling exhaust from the 500-hp of diesels down to about 300 F (a safe limit to prevent sulphurous acid corrosion) approximately 1,000 gal. of water per hr can be heated from 60 to 200 F.

The heat-recovery system operates more or less independently of the loading on the engines, since the combination of ac and dc power loads and refrigeration demand governs prime-mover operation. Under normal conditions, dc load runs light in the daytime, building up to a maximum between late afternoon and 10 p.m. when truck batteries are charged. During the day, ac load can be carried on one 50-kw machine, but this load also builds up at night. Then two diesel-engine generators and one steam-driven unit are required to handle the load; running the steam unit balances the steam engine on the dc load and helps out with the hot-water heating. The refrigeration load runs highest at night, and is, of course, light in winter and heavy in summer.

Lowered Costs

Progressive improvement in the power plant reflects in lowered costs for power services. No record of costs is available for the period before Borden took over Willow Brook, but taking cost in 1936 as 1, the 1937 figure was 0.82, dropping to 0.62 in 1938, and to 0.55 for the first 10 months of 1939. The double-circuit, continuous-circulation jacket-water system has eliminated cracked cylinders, which occasionally resulted from starting up the engines with cold jacket water. Quick starting and reduced bearing wear are additional advantages. The double circuit eliminates scale problems in the jackets.



Two exhaust-gas heaters stand in front of 4000-gal. hot-water tank

LETTERS FROM A TURBINE SPECIALIST

No. 5—On a Governing Question

By F S KOHL and
L B WALES
General Electric Co, Lynn, Mass.

Turbine Specialist
District Office
Dear Mr Specialist:

You will recall that during your last visit we were discussing the possibility of installing a topping turbine. With the data you gave me, I have worked up the enclosed layout, which seems to fill the bill as far as load and steam requirements are concerned.

One thing bothers me—what is going to happen to our station frequency?

Our 200-lb plant steam requirements are quite variable. If the flow passes through the topping turbine (No. 3) instead of coming directly from the boilers, as is now the case, the load on the "topper" will vary. With a constant station load, this means that there would be a continual "swapping" of load back and forth between No. 3 and the two present condensing units (Nos. 1 and 2). I imagine that our frequency would be anything but stable. We could not tolerate this as many of our manufacturing operations require almost constant frequency.

Can you run through what you might call a "station governing" study? What would our maximum frequency variation be? If it is too great, what would you suggest that we do to correct it?

Very truly yours,
Engineer

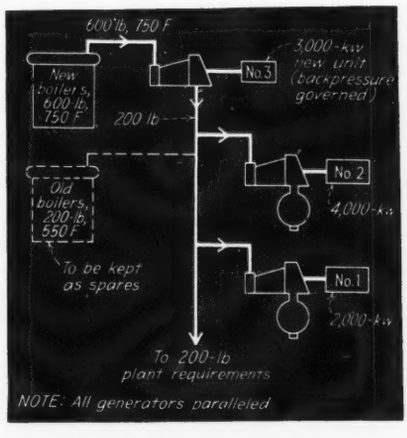


Fig. 1—Flow diagram of proposed topping unit exhausting at 200-lb present-plant pressure

Dear Mr Engineer:

Your question about station frequency is such an interesting one that I am outlining below the steps taken in solving it. This method may be helpful in other cases as it has a wide range of application.

Based on data you gave me, I have "chased your cycles" around the station and find that 0.54 cycles is about the maximum variation that would be expected. If this is too great it would be advisable to install a speed corrector on unit No. 1. I'll go into this later.

Here's how I got the 0.54 cycles. As I recall you expected an average load of about 7000 kw and an average 200-lb plant requirement of about 60,000 lb per hr. In order to determine the load distribution, I have made up estimating performance curves of both the old and the proposed units, Fig. 1. Note that the performance of No. 1 (2000-kw) and No. 2 (4000 kw) is combined on one curve because, in a study of this type, it is somewhat easier to handle similar machines as a group.

The 7000 kw could be carried with a flow of about 70,000 lbs per hr going straight through No. 3 to Nos. 1 and 2 and then to the condensers. Under this condition there would be about 1400 kw on No. 3 and 5600 kw on Nos. 1 and 2. Assume that you are running along this way with no 200-lb steam going to the plant. The frequency is set at 60 cycles.

Now assume the 60,000-lb-per-hr plant requirement comes on the 200-lb header. The back-pressure governor of No. 3 calls for more steam to be admitted at the throttle. With the station load remaining the same, you can, by working back through the performance curves, find that the new flow to throttle is 115,000 lb per hr instead of 70,000 lb per hr. The load on No. 3 has increased from 1400 kw to 2750 kw, a change of 1350 kw. To offset this, units Nos. 1 and 2 must drop 1350 kw.

From our files I found that each of these two units has a 4% regulation (a 4% speed change for a load change

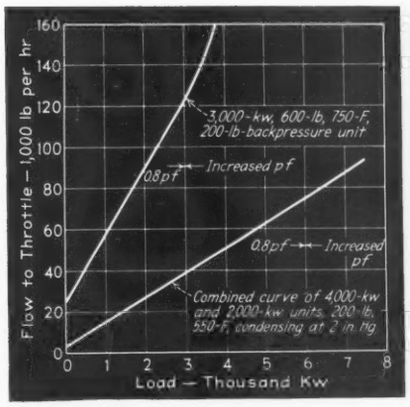


Fig. 2—Steam-flow performance curves for top turbine and combination of condensing units

from full load to zero). Taking units Nos. 1 and 2 as one 6000-kw unit, a drop of 1350 kw would mean a speed increase of $\frac{1350}{6000} \times 4\% = 0.9\%$ and $0.9\% \times 60$ cycles $= 0.54$ cycles. The new station frequency would be 60.54 cycles.

Variations larger than 60,000 lb per hour in the 200-lb plant header would mean correspondingly greater frequency variations.

If you feel that this case is typical, and the frequency variation too great, it would be advisable to install a speed corrector on the condensing unit on which you expect to take these load swings. No doubt you will want to operate No. 2 at essentially base load. No. 1 could be kept by occasional hand adjustment at such a load that the swings would come within its capacity. Application of the speed corrector to unit No. 1 would not change its instantaneous regulation, but would give it a settled regulation of zero. This means that all swings would be absorbed by No. 1. After any change the speed would be corrected to 60 cycles in about 30 seconds.

Does this clear up your question? If not, drop me a line and I'll stop in on my next trip.

Sincerely yours,
Turbine Specialist

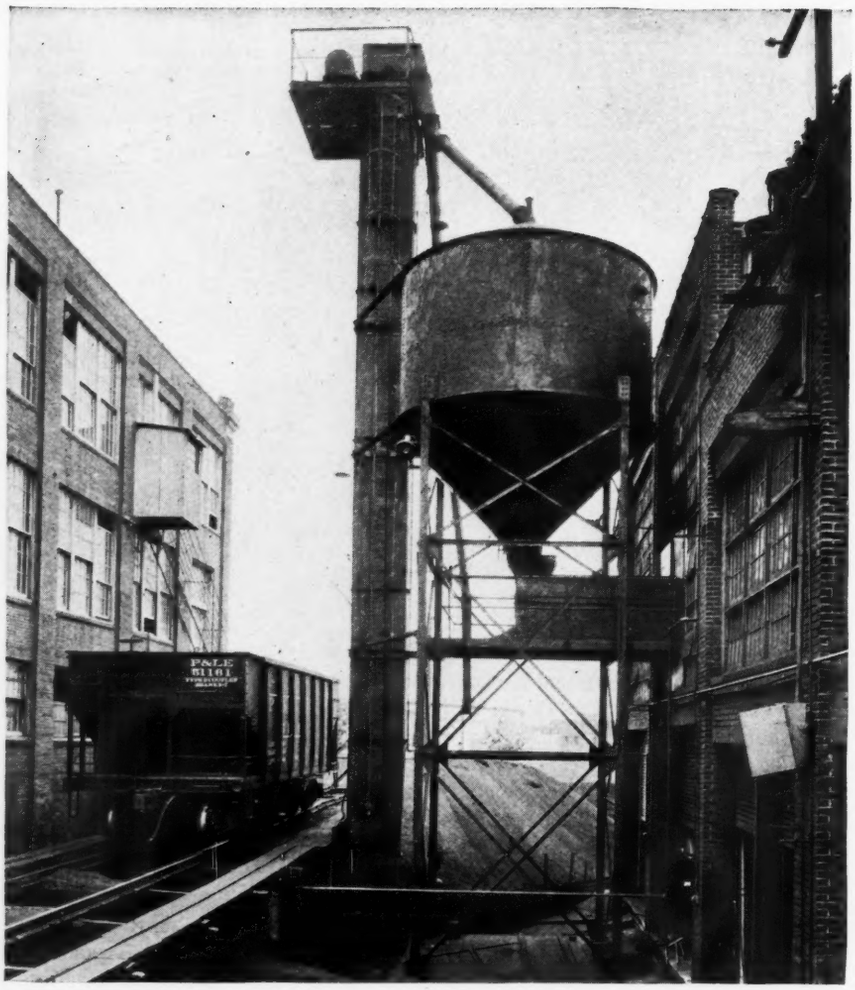


Fig. 1—Coal-handling equipment consists of a track hopper, reciprocating conveyor, bucket elevator, 60-ton bunker and horizontal belt conveyor

Small-Plant Coal-Handling Equipment Pays

By W A LOFFT
Chief Engineer, Eavenson & Levering Co

Mechanical coal-handling equipment and automatic weighing scales installed in New Jersey wool-scouring plant save over $4000 per year and give three men better jobs

A $10,000 INVESTMENT in coal-handling and weighing equipment for our wool-scouring plant in Camden, N. J., is paying out at the rate of 40% per year. This equipment permits us to check the dollars and cents value of different grades of coal. We have found that just as high boiler and furnace efficiency can be obtained with some of the lower grades of coal as with the more expensive, with a saving of about $2200 per year in coal cost.

Reduction of coal dust and elimination of the back-breaking job of manual coal handling are other advantages of the new equipment. Previously, it required three men to unload coal and get it into the plant; now, one man can easily do the job working one shift. The other two men are used on maintenance and construction work in the production plant and their wages are no longer charged to power generation.

How It Works

The new equipment, Fig. 1, consists of a track hopper, a reciprocating conveyor, a bucket elevator discharging to a 60-ton metal bunker, and a horizontal belt conveyor from the bunker to a weighing scale. The latter drops batches of weighed coal into either one of two hoppers on the coal pulverizers. The entire system is enclosed, to avoid dust and permit operation under all weather conditions. All conveyors operate by pushbutton control, and are electrically interlocked to permit automatic operation and to avoid overfilling the bunker or pulverizer hoppers. If coal jams up anywhere in the system, conveyors feeding this point automatically shut down.

It requires about two hours to empty a carload of coal and store it in the elevated bunker. When a car is empty, a shifting engine generally centers the next car over the hopper. The trestle over the track hopper permits spotting three cars at one time. When necessary, cars can be moved by hand.

Since installation, a switch has been added at the top of the elevator, and a discharge pipe installed with a flexible hose at the end for unloading coal for storage near the elevator. Coal is reclaimed from storage by a horizontal conveyor pivoted at the discharge end. A set of wheels on the opposite end allow us to keep the conveyor against the storage pile at all times when reclaiming. By this means coal can be reclaimed anywhere in the yard within the radius of the ground conveyor.

The weigh scale operates automatically. When the operator desires coal for the pulverizers, he presses a push-

button to start the horizontal conveyor from the bunker to the scales. Coal falls from the end of the conveyor into the scale receptacle until 200 lb has accumulated. At this point, the conveyor stops and the clamshell bottom of the weighing receptacle opens, dropping the weighted coal into whichever pulverizer hopper the operator wants to fill. When the clamshell bottom closes, the conveyor again starts delivering coal. As 200-lb batches are dropped every 15 sec, it requires about 5 minutes to fill the 2-ton hopper on a pulverizer. As soon as the hopper is full, the conveyor automatically shuts down, unless the operator has directed flow of coal to the other hopper by a flip-gate.

An automatic tabulator on the tripping device of the scale keeps an accurate record of each 200-lb batch delivered. Other tabulators are to be installed on the flip-gate to the pulverizer hoppers, to record how many batches are deposited into each pulverizer. One pulverizer supplies fuel for each of the two 4000-sq-ft boilers. A lever and compensating weight on the scales make checking and adjustment easy. Once a week the operator checks the scales for accuracy.

When the equipment was installed, tests were made on carload lots of coal to determine the advantages of each fuel. These tests included the cost per 1000 lb of steam, the amount of steam per pound of coal, and the general physical condition of the furnace and boiler tubes following each run with a certain grade of coal. These complete records showed that a cheaper-grade coal than was being burned could be used with the same combustion results. They also showed up various expensive grades of coal which were not evaporating the amount of water that their higher cost warranted. By selecting a good medium-grade fuel that produced the best average results, it has been possible to reduce fuel costs at least 20 cents per ton.

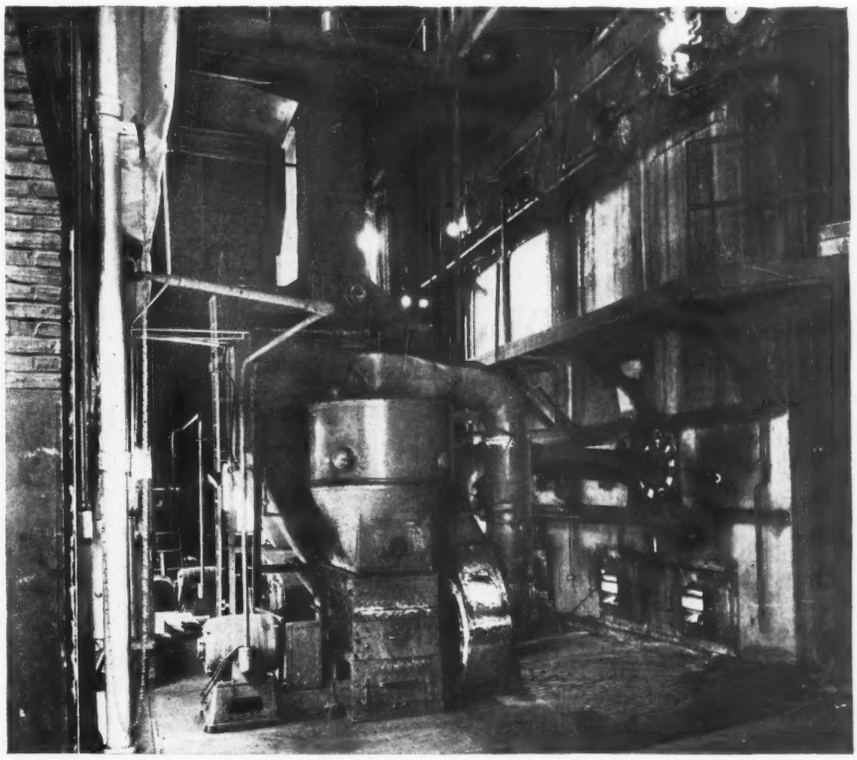


Fig. 2—Coal is weighed automatically from the bunker to either of two pulverizers

Exhaust Lines

By L N ROWLEY

Tipped off by the hobo grapevine, transient derelicts head for the "hotplate" when they hit Erie, Pa., according to the Erie *Daily Times*. "Hotplate" is hobo jargon for manhole covers on a section of tunnel carrying steam pipes from a local utility. For many years this informal "heat recovery" has substituted for warm bedding; even in zero weather an unfortunate can keep from freezing by curling up on the cover with a newspaper or sheet of tarpaper for a blanket.

Pure coal gas will be pumped direct from pithead plants to strategic distributing centers and then to customers in a new gas grid to be put in operation soon, in Yorkshire, England. According to Gas Age-Record, the scheme aims to make British industry independent of imported fuel and may eventually take in other industrial areas of the British isles.

A consulting engineer friend tells a story which proves you've got to talk in a man's own language if you want to get over a point. It seems that an underwear manufacturer was being shown through a large turbine shop. He seemed singularly unimpressed by all he saw, even when shown a turbine similar to the one being considered for his own factory. He perked up, however, when a smart lad in the group referred to the turbine-generator as a "20,000-union-suit" machine. That was *his* way of measuring capacity while kilowatts was just another bit of engineering mumbo-jumbo. PS: He bought the turbine.

In spite of all the gloomy prophecies of the sentimentalists and the gags of vaudeville teams, there is more real "horse" power in this country today than ever before. What's more, a good Iowa farm horse today can pull more weight and plow more land than horses of the "good old days". Guess we might admit horse breeders to the power engineering fraternity—they're out to get more horsepower per lb, just as we are.

Most of us sneer at reading the future in tea leaves, but even hardboiled engineers have to admit there's something in a new Swedish method of prospecting for minerals by reading *tree* leaves. It's really not as queer as it sounds; minerals leave traces in water in the earth, trees suck up the mineral-bearing water, and traces of metals are finally stored in the leaves. All you have to do is pick up a few leaves, examine them in the laboratory, and presto, you've found a gold mine in your backyard!

According to the Engineer, of London, Soviet scientists who tried a mixture of liquefied butane and propane as motor fuel found that it has better antiknock properties than ordinary gasoline and starts faster in cold weather. Maybe that's what's needed to make all those beautiful Xmas cigarette lighters work.

Meter Records Boiler Efficiency

Unique device measures useful output and losses to produce direct efficiency records. Tests show difference of less than 1% from calculated efficiencies

A NEW TYPE of instrument, recording boiler efficiency directly, has been developed by W E Germer, of Berlin, Germany, and described in the July, 1939, number of *Archiv fuer Waermewirtschaft*. In effect, the instrument automatically measures the useful heat output and the boiler losses, and computes the efficiency as the useful output, divided by the sum of useful output and boiler losses.

Useful output is measured directly by a reliable steam meter operating on the pressure-differential principle. Neither the quantity nor the heat value of the fuel is considered.

Boiler losses are divided into two parts—those that are large and variable; and those that are small and practically constant (or negligible). The instrument actually measures the primary loss—the sensible heat (above atmosphere) of the entire volume of flue gas discharged up the stack. A large Venturi-type orifice meter is incorporated in the base of the stack and connected to a sensitive counterbalanced liquid-sealed bell-type gage. Gas temperature is measured by an electric-resistance thermometer directly connected with the main recorder circuit. This hookup takes care of the variations in the difference between the gas and outside air temperatures, also volume variations.

Takes Care of Losses

The machine adds a constant amount to take care of the other losses, the amount being fixed in the preliminary adjustment of the instrument to suit the particular boiler. The radiation losses so provided for generally range from 1 to 3%. They are little influenced by the nature of the fuel or by boiler loading. An average of 2% is generally allowed for the loss by ash and soot. Operation of the recorder does not depend upon any computation (mechanical or otherwise) of the loss due to CO and H_2. The procedure, rather, is to install a CO + H_2 meter, and, using this, to operate the boiler to make this combined unburned-gas loss negligible.

Feedwater temperature is, of course, an element in net output and the machine can be designed to incorporate it. However, in most installations the variations in water temperature are too small to have a significant effect on conditions. The feed measurement may then be eliminated and a factor for the average water temperature incorporated in the instrument.

Further instruments, such as meters to check the power consumption of the different auxiliary drives, may, of course, be provided, but these have no functional connection with the efficiency recorder.

Tests

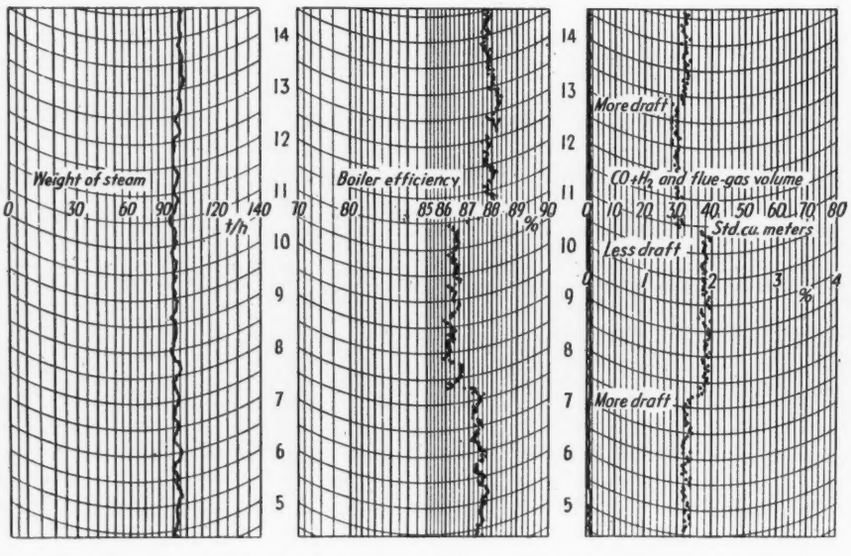
The illustration shows a section of roll chart from the recorder. Steam output, for the case shown, amounts to about 90 tons per hour (198,000 lb per hr). Note that original efficiency (at bottom of chart) is from 87 to 88%. At 7:30 the boiler was given slightly more air than desirable for best results, increasing the flue-gas volume from about 33 to 38 standard cubic meters per hour. Efficiencies, as shown on the righthand chart, immediately dropped about 1.2%.

At about 11 o'clock the air supply was reduced to give a flue-gas flow of about 30 standard cubic meters per hour. Efficiency immediately jumped 1.8% to 88. The wavy line close to zero at the left of the third chart shows CO + H_2 percentage; the other line shows gas volume. It will be noted that this loss is negligible.

The degree of accuracy obtainable with this novel equipment has been shown by different tests. The table below gives a summary of the results of three such tests.

TESTS OF BOILER EFFICIENCY METER

Test No.	Duration, hrs.	Boiler output, lb per hr.	CO_2 %	Efficiencies	
				Calculated	Recorded
1	7	165,000	13.3	88.2	87.3
2	7	170,720	14.3	88.4	87.9
3	6	207,900	15.6	88.2	88.5


Weight of steam
0 30 60 90 120 140 t/h
14 13 12 11 10 9 8 7 6 5
Boiler efficiency
10 80 85 86 87 88 89 90 %
More draft
CO+H2 and flue-gas volume
0 10 20 30 40 50 60 70 80
Std.cu. meters
Less draft
0 1 2 3 4 %
More draft

Section of roll chart showing boiler output, efficiency, CO + H_2 loss and flue-gas volume

Ford Installs 110,000-Kilowatt Hydrogen-Cooled Generator

Vertical-compound unit, consisting of two 55,000-kw, 1800-rpm turbine-generators mounted one above the other, is first large industrial to be hydrogen cooled

By D S SNELL
Central Station Dept, General Electric Co

A NEW CHAPTER in industrial-power production was recently begun when the new 110,000-kw hydrogen-cooled generating unit at the Rouge Plant of the Ford Motor Co, Dearborn, Mich., went into service. The newly installed machine was preceded at the Rouge plant by two other generating units of like capacity, one installed in 1931 and the other in 1936, both air-cooled.

Hydrogen cooling was adopted for the new Ford generator principally because of 1% gain in full-load efficiency as compared with air cooling. Due to the low density of hydrogen, it practically eliminates windage and ventilation losses in evidence with air cooling. Hydrogen cooling permits about 20% increase over air in generator output per pound of active material. Windage noise is practically eliminated, and winding-insulation life is longer due to absence of moisture, oxygen, dirt, and damage from corona.

The first hydrogen-cooled generator went into service at Dayton, Ohio, October, 1937. A total of 18 hydrogen-cooled generators, having an aggregate capacity of 1,073,000 kva, are now in operation. All, except the Ford unit, are in public utility plants.

Fig. 1 shows the new generating unit, with one of the original machines in the background. Like the two earlier machines, the new unit consists of two 1800-rpm, 68,750-kva, 0.80-pf, 60-cycle, 13,800-volt turbine-generators mounted one above the other in a common struc-

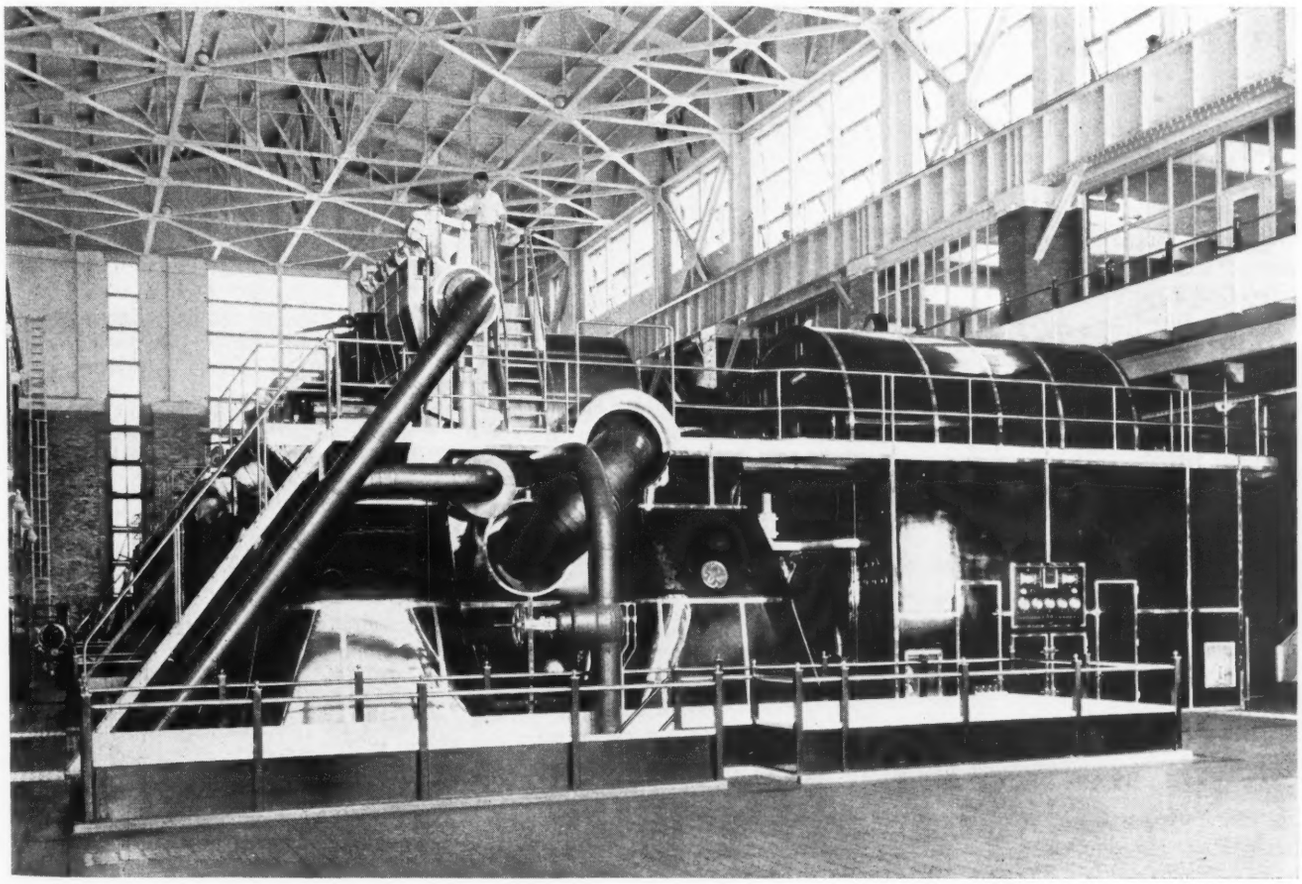


Fig. 1—Plant contains three 110,000-kw vertical-compound turbine-generators with hydrogen-cooled unit in foreground

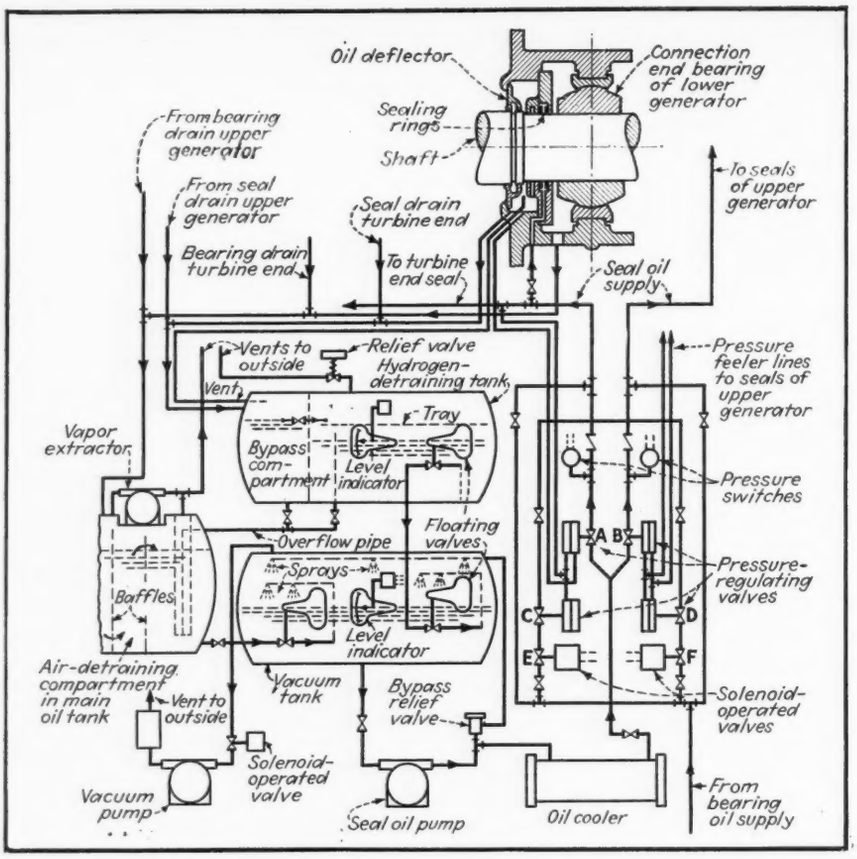


Fig. 2—System for maintaining oil seals around the shafts at the bearings prevents air leaking into the generators and hydrogen leaking out

tural frame. Excitation is by a 450-kw, 250-volt exciter mounted on a shaft extension of the lower generator. The upper generator is driven by a turbine operating on 1200-lb, 900-F steam, and exhausting to the lower turbine at 85 lb and 400 F. Known as a vertical-compound machine, this unit has the advantage of larger capacity in a given floor space than obtained with the conventional design.

Stator Frames

Stator frames are completely fabricated, with exception of the cast-steel bearing supports. The stator windings consist of two coil bars per slot, each bar being made up of separate strands of copper, transposed throughout the bar length to avoid eddy currents, and insulated with several layers of mica tape. The coils are connected to form two separate windings in multiple, each normally carrying one half total load but arranged so that one may be loaded independently of the other.

The two generators are connected in multiple with the terminals of the two sets of windings brought out at opposite ends of the lower machine. A double stator winding reduces short-circuit currents, allows starting both generators in synchronism without connecting their windings to the buses, and one-half total output of the generators can be carried equally between one half the windings in each machine, with the other pair of windings unloaded.

The rotor core of each machine, a one-piece steel forging, has slots milled in the body portion which carry the distributed field winding of 5 coils per pole. Rotor-winding ends are ventilated through holes in the retaining rings, while the body portion is ventilated by axial and radial ducts. The axial ducts beneath the coil slots communicate with radial ducts in the rotor core. Centrifugal pressure developed in the radial ducts draws hydrogen into the axial ducts from the rotor ends and discharges it into the gap between rotor and stator.

Ventilating Fan

A 26,000-cfm centrifugal fan at each end of the rotor circulates the hydrogen required for ventilating the stator. A diffuser at the outlet of each fan recovers part of the velocity pressure of the fan to give a fan efficiency of approximately 50%.

Hydrogen is circulated through the stator in a multiple-radial system. Part of the gas discharged from the fans passes into the end of the gap between rotor and stator and from there flows radially outward through stator ventilating ducts. The remainder of the hydrogen flows back of the stator core to the center of the machine and radially inward to the gap between rotor and stator, then out through other ventilating ducts in the stator.

Each generator has two hydrogen coolers, each consisting of a number of finned tubes arranged in multiple for flow of water through them. Cover plates in the generator end shields give access to the cooler tubes for cleaning without removal of hydrogen from the machine.

Oil-Film Seal

An oil-film seal around the shaft, Fig. 2, in each bearing, prevents escape of hydrogen along the rotating shafts. This seal is essentially a pair of rings in a housing attached to the bearing, to which vacuum-treated lubricating oil is supplied under pressure. Vacuum-treatment of the oil removes practically all air and hydrogen so that the oil will not liberate air into the hydrogen and hydrogen into the bearing-lubrication system. The former would reduce hydrogen purity and the latter create an explosive mixture. A mixture of between 5 and 75% hydrogen in air is inflammable.

Oil supplied to the sealing rings is treated in a horizontal hydrogen-detraining tank, a vacuum tank and a detraining compartment in the main-oil reservoir, Fig. 2. The hydrogen-detraining tank and air-detraining compartment remove the larger bubbles of hydrogen and air from the oil flowing from the sealing rings, before the oil goes to the vacuum tank, where practically all hydrogen and air remaining in it is removed. In the vacuum tank, approximately 0.3 in. of mercury is maintained by a rotary vacuum pump.

Pressure Differential

An oversized rotary pump supplies oil from the vacuum tank to the sealing rings. Oil in excess of seal requirements bypasses into the vacuum tank and discharges through spray nozzles to aid the vacuum treatment. Two pressure-regulating valves *A* and *B* maintain a constant differential between oil pressure at the seals and gas pressure in the generator casing.

Failure of the vacuum-treating system causes solenoid valves *E* and *F* to open, which permits supplying bearing-lubricating oil to the sealing rings through pressure-regulating valves *C* and *D*. Untreated oil in the seals causes a gradual decrease of the hydrogen

purity and should not be used except in emergency. If untreated oil is used for sufficient time in the bearing seals, generator casings have to be scavenged with fresh hydrogen to keep hydrogen purity within satisfactory limits. The vacuum-treating system maintains automatically a hydrogen purity of 98% in the generators at all times.

Hydrogen from commercial cylinders is supplied to the generators through pressure-control valves, see Fig. 3. Both generator casings are connected together through the armature-terminal conduits to maintain a common hydrogen pressure of about 10 in. of water. A relief valve on the hydrogen-detraining tank discharges hydrogen to atmosphere if casing pressure exceeds about 1 lb. This valve is also used for scavenging the generator casings to increase hydrogen purity, if this becomes necessary.

Carbon-Dioxide Purge

Carbon-dioxide is used to purge the casings of air before admitting hydrogen and for removing hydrogen when this becomes necessary. Carbon-dioxide is admitted at the bottoms of the two casings and the air or hydrogen discharged from the hydrogen-feed pipe at the top. A leakage detector on each generator operates an alarm if water or oil gets into the casings through defective cooler tubes or improper shaft seals.

A control panel on the side of the lower generator, Fig. 1, carries the instruments required for operating the generators in hydrogen and provides access to the gas-control valves. The instruments include a hydrogen-purity indicator for each generator; a double-scale fan-pressure gage that shows the fan pressure in each generator, which is a measure of the hydrogen purity; gages for indicating hydrogen pressure in the casings, reduced pressure at the hydrogen containers, and amount of vacuum in the vacuum tank; and thermometers for indicating hydrogen temperature entering the coolers of each generator. An alarm system on the control panel notifies the operator of any abnormal condition in either the shaft-sealing or gas-control systems.

The generators were placed in operation with hydrogen on August 21, 1939, following a short period of service with air cooling. Operation of the various auxiliaries has been satisfactory and no operating difficulties have been experienced. Since control of the hydrogen system is entirely automatic, operation of the new unit is not appreciably more difficult than that of the earlier air-cooled ones. Hydrogen cooling of the new unit has been amply justified by the operating economies obtained.

Correction

The table of principal equipment for the Front Royal plant of the American Viscose Corp, page 73, December POWER, inadvertently omitted the item of breechings and duct work by Connery Construction Co, Philadelphia, Pa. Also, listed under valves should have been Chapman Valve Mfg Co and Wm Powell Co.

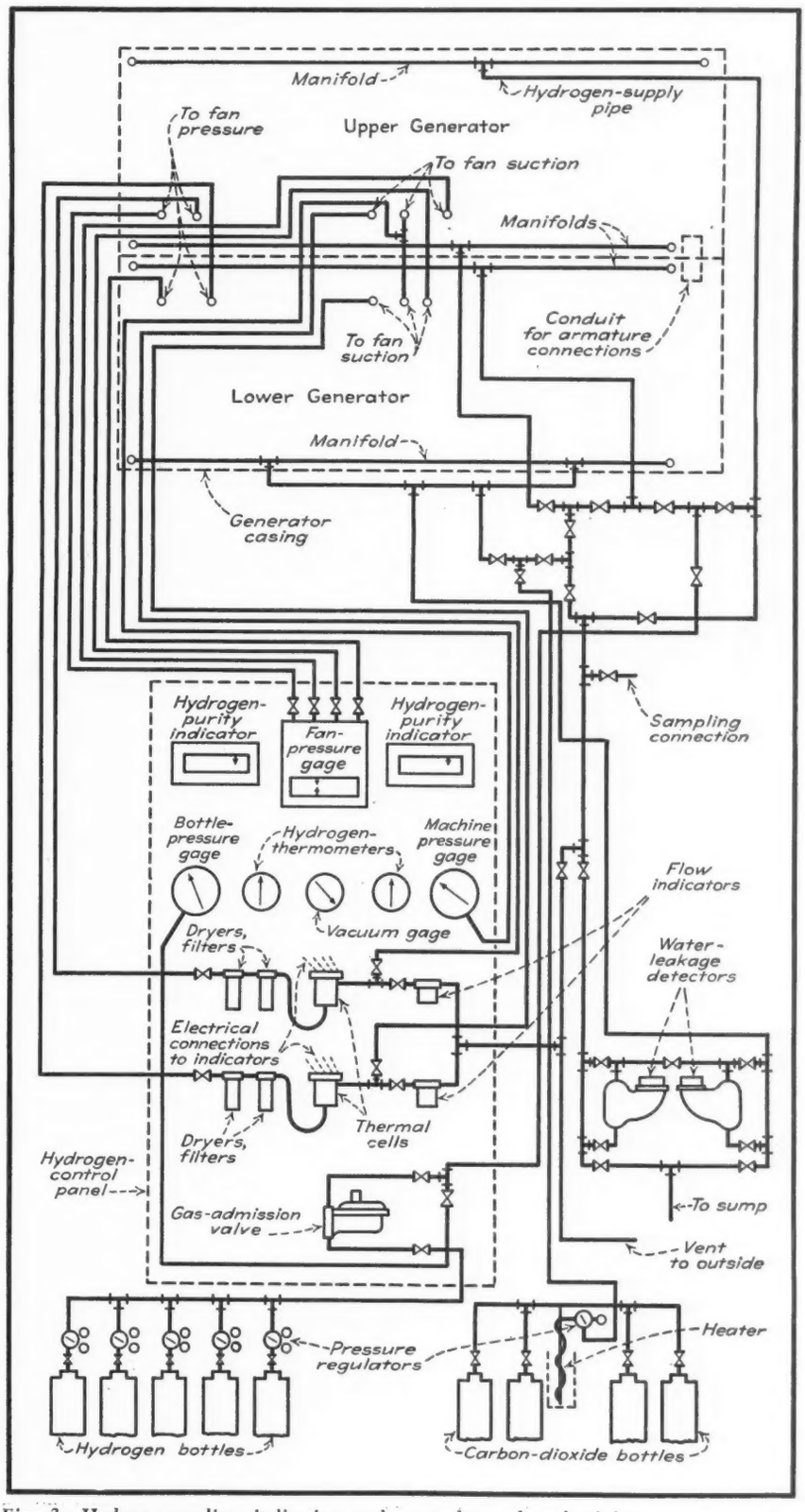
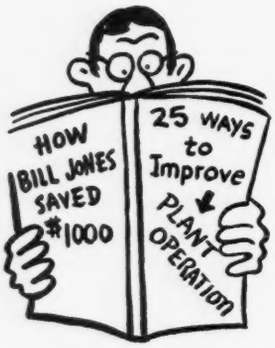


Fig. 3—Hydrogen-cooling indicating and control panel and piping connections for supplying hydrogen or carbon-dioxide to the generators

Speaking of Power



Stuff Power Men Like

Perhaps I've told you before that POWER has run a straw vote every month for years. We've worked out a method of sampling readers as precisely as you'd sample a carload of coal. This sample is small, but truly representative of our readership from coast to coast. . . . We use a different batch of names each month so as not to bother the same man twice. We ask each reader on this list which articles in the current issue he liked best. Then we tabulate the results for our own guidance in planning future issues. . . . This continuing study has confirmed some of our theories about what power men like to read. It has also taught us many things we did not know before. Every time we learn how, we try to improve the magazine . . . This monthly poll was one of the factors that led to the birth of the Operating Engineer section last June. Subsequent tests prove that it is going over and suggest ways for still further improvement of this practical service to the man on the operating job.

The editor's face is red. Reminding us that "pride goeth before a fall", J C Porter notes a typographical error in our November item on this page bragging about the award we got for excellence in pictorial reporting. We said the award was for a hookup issue "published in December, 1939". It should have been 1938, of course. "All in fun", concludes Porter.

A subscriber reminds us that POWER is read quite a bit at sea: "A great part of POWER readers are ex-marine engineers, and not a few are marine men, who also hold stationary tickets, take the magazine to sea with them, and the books are passed around among crews of different ships in all parts. Being an ex-marine engineer myself, I have practical knowledge of this". . . . This being the case, he urges us to give our sea-going readers a better break by publishing articles on oil burning at sea, care and installation of marine turbines, propeller problems, marine radio installations, etc. . . . We are flattered by this attention, having a real respect for the marine engineer and a personal interest in his problems. The fact remains that we have bitten off a pretty big list of stationary engineering subjects to cover. If we try to spread ourselves over the seven seas, we can't do quite as good a job for our primary clients on land. . . . It seems that we must continue along present lines, hoping that now and then what we have to say about a stationary boiler, oil burner, turbine or pump will be of some value to the fellow who works out where men are men and there aren't any taxicabs.

Where There Ain't No Taxis

Speaking of practical presentations for the Operating Engineer, we've got something really hot on the griddle right now. Starting in February, we plan to present a "How To" series on elementary water analysis with every single step completely illustrated by photographs specially posed for this series. The aim is to provide a guide so down-to-brass-tacks that the man without any chemical training can go right through a test without the slightest difficulty. . . . Keep an eye out for this series. Tell us how you like it. If it goes over as well as we expect, we can apply the same idea to other subjects.

Hot Off The Griddle

Phil Sprague, president of Hays Corp, sends me a copy of the Fremont, Neb., Daily Tribune—power-plant section—eight big pages devoted entirely to the history and achievements of the city plant. . . . Quite naturally, the thing that caught his eye was a big front-page picture of the "Robot Fireman", the boiler-room instrument and control board. . . . Engineers are getting used to the idea of automatic firing and control, but it's still pure romance to the citizen who fires his cellar boiler with a shovel, measures room temperature with the back of his neck, and controls by pushing dampers with his heels and his fist.

Ideas Are Like Eggs

In a recent paper before the Society for the Promotion of Engineering Education, A R Stevenson, Jr, of General Electric, tells how new products are developed, all the way from first idea to marketing. . . . What happens to a good idea depends on how it's handled, he said. It's like an egg. Warm it gently for the right number of weeks and you get a chicken. If you try to rush the process you get a hard-boiled egg. But don't take too long about it and let the egg get cold or you'll finally end up with a rotten egg.

My vote is that the annual meeting of the ASME was a great success. First time away from New York in the Society's history. . . . Which makes me wonder whether this away-from-home idea shouldn't be repeated some time, perhaps in Chicago.—*Phil Swain.*

Away-From-Home Success

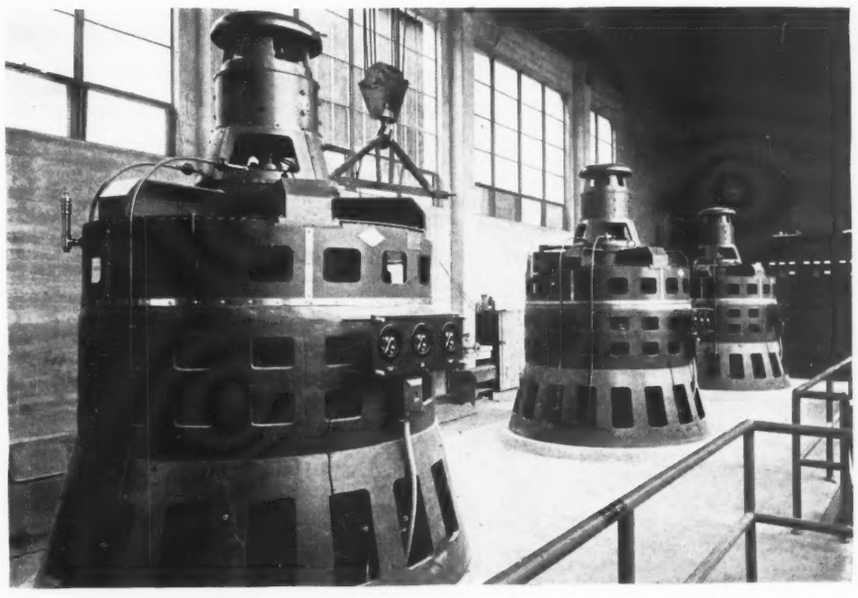
Water Over the Hill

Water is pumped from the Flathead River through 630 ft of 48-in. pipe

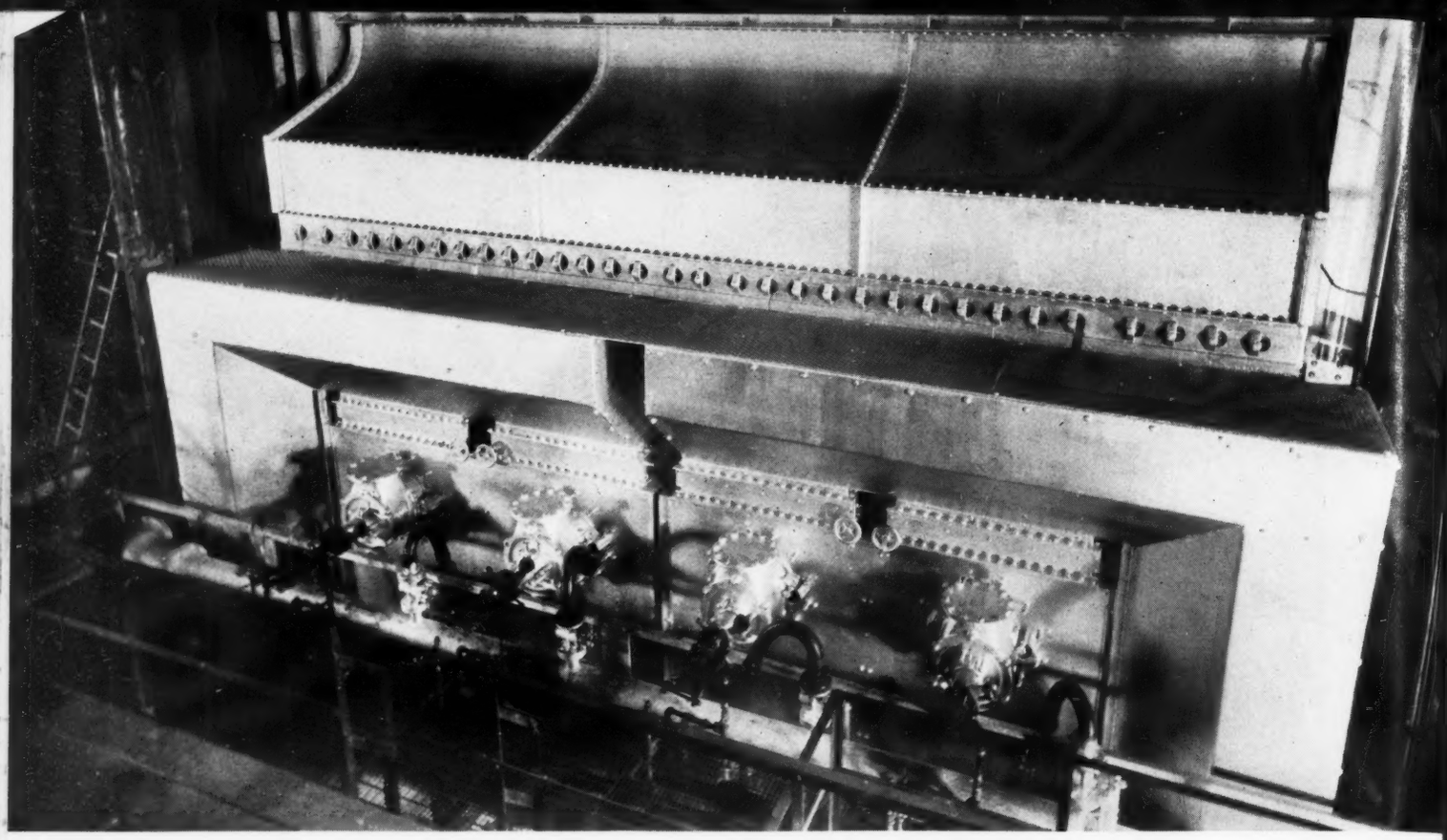
PUMPING LIFE-GIVING water from the Flathead River to make arid Montana fields grow green is the job of this plant two miles from Polson, Mont. After a lift of over 300 ft, water flows 2.5 miles in an open canal to Pablo Reservoir, there stored for irrigation.

Three Worthington, single-stage, bottom-suction, 30-in. discharge centrifugal pumps are rated 30,000 gpm each against a total dynamic head of 335 ft, with a minimum suction submergence of 8 ft. Impellers are bronze with renewable wearing rings.

Each pump is driven by an Elliott Co. 3000-hp, unity-power-factor, 2300-volt, 900-rpm, vertical synchronous motor, with direct-connected, 10-kw exciter. Energy comes from the Montana Power Co's generating station at Polson Dam, about three miles away. Power is transmitted over a 34,500-volt line and is stepped down to 2400 volts in a substation near the pumping plant.



Three 3000-hp vertical synchronous motors drive 30,000-gpm centrifugal pumps



—installed their first Riley unit in 1934, a duplicate in 1937, another duplicate in 1939

When one of America's leading industrial companies places three separate orders for Riley Boiler units of 300,000 pounds per hour capacity in a period of five years, can you ask for more conclusive evidence of the excellent performance and dependability of Riley units.

The second and third orders were not placed until after the first unit had performed with complete satisfaction for a period of over three years with efficiencies considerably in excess of guarantees and with an unusual record of availability. Each of the three units was initially placed on the line without the necessity of shutdowns for adjustments, was kept on the line for extended periods and gave complete satisfaction from the start.

It is because of similar results from Riley installations throughout the world that plant after plant is swinging to Riley equipment . . . because users have found performance and capacity better than guarantees and because excellent design and workmanship assure positive dependability. When you purchase Riley equipment you are getting plus values . . . more value for your money.

When considering boiler or fuel burning equipment, it will pay you to visit a number of modern Riley installations. You can never fully appreciate how well Riley units perform or what excellent workmanship goes into them until you do so.

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Pittsburgh Buffalo Cleveland Detroit Tacoma Baltimore Milwaukee Denver
St. Louis Cincinnati Houston Chicago St. Paul Kansas City Los Angeles Atlanta Memphis New Orleans

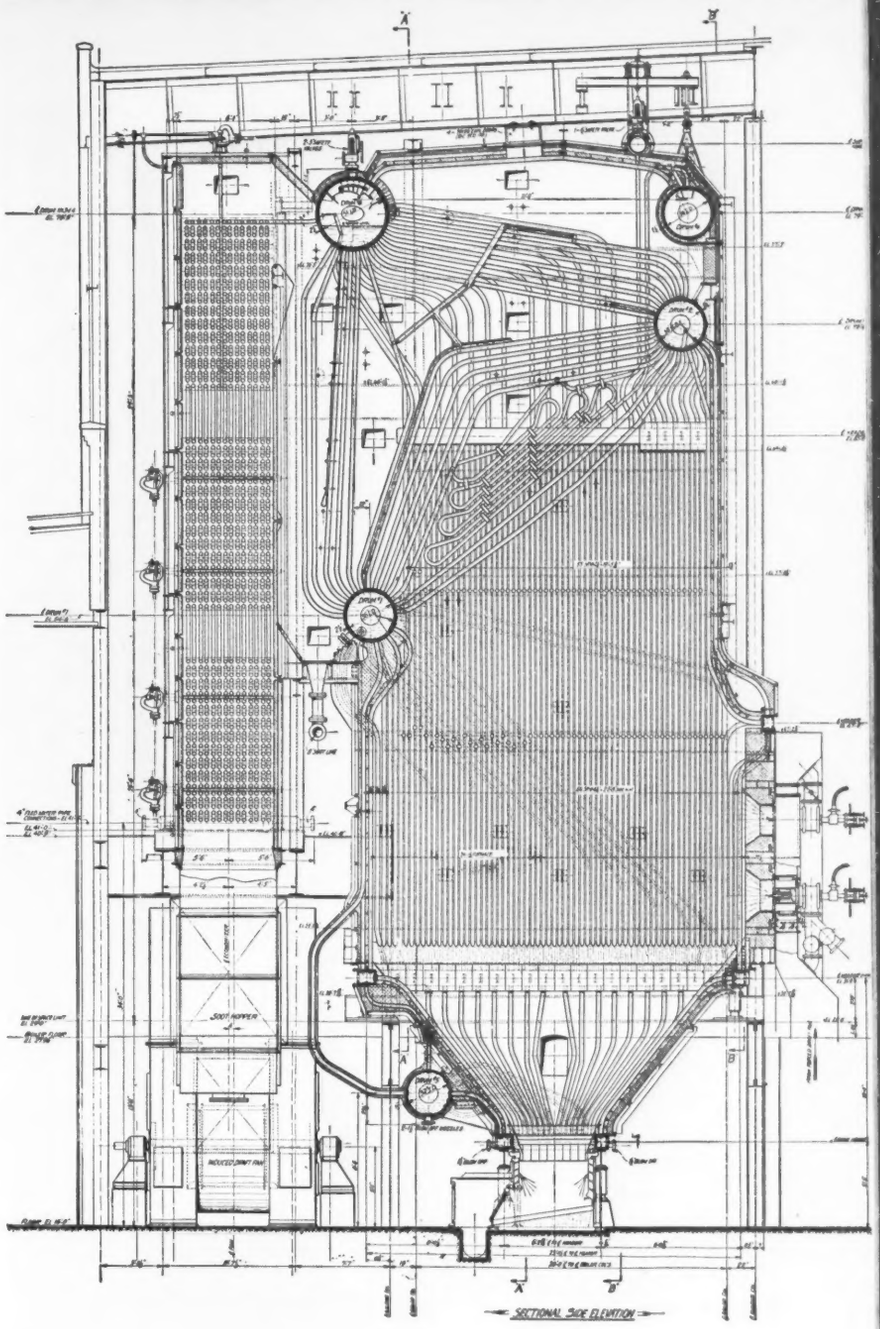
It will pay you to visit modern Riley Installations

a comparison of actual and guaranteed performance shows one big reason why repeat orders were placed.

	Actual Performance at 233,677 lbs./hr.	Guaranteed Performance at 225,000 lbs./hr.
Steam Pressure	666	650
Steam Temperature	747	730
Temp. Gas Leaving Econ.	381	462
Temp. Water Entering Econ.	201	320
Combined Efficiency	86.7	83.3
Loss Moisture in Fuel	.3	0
Loss Hydrogen	5.7	6.74
Loss Dry Chimney Gas	6.6	7.89
Rad. & Unaccounted for	.7	2.07

engineering data:

Maximum Capacity	300,000 lbs/hr.
Boiler Heating Surface	15,000 sq. ft.
Water Wall Heating Surface	7,500 sq. ft.
Economizer Heating Surface	14,000 sq. ft.
Furnace Volume	17,000 cu. ft.
Heat Release	25,900 B. T. U.
Furnace Width	22′ 6″
Furnace Depth	24′ 1½″
Fuels	Fuel Oil, Refinery Gas, Acid Sludge



A FEW RECENT INSTALLATIONS AND SALES OF RILEY UNITS

Central Illinois Light Co., Peoria, Ill.
375,000 lbs./hr. 900 lbs.—900°F

Houston Lighting & Power Co., Houston, Texas 250,000 lbs./hr. 975 lbs.—910°F

Shell Oil Co., Wood River, Ill.
125,000 lbs./hr. 700 lbs.—750°F

Ohio Salt Co., Rittman, Ohio
120,000 lbs./hr. 275 lbs.

Union Public Service Co., Canby, Minn.
75,000 lbs./hr. 515 lbs.—825°F

Worcester Salt Co., Silver Springs, N. Y.
150,000 lbs./hr. 250 lbs.—465°F

Allis Chalmers Mfg. Co., Milwaukee, Wis.
150,000 lbs./hr. 200 lbs.—452°F

Northern Paper Mills, Green Bay, Wis.
75,000 lbs./hr. 700 lbs.—700°F

Union Electric Co. of Mo., St. Louis, Mo.
300,000 lbs./hr. 275 lbs.—525°F

Scoville Mfg. Co., Waterbury, Conn.
250,000 lbs./hr. 725 lbs.—750°F

St. Croix Paper Co., Woodland, Me.
125,000 lbs./hr. 475 lbs.—715°F

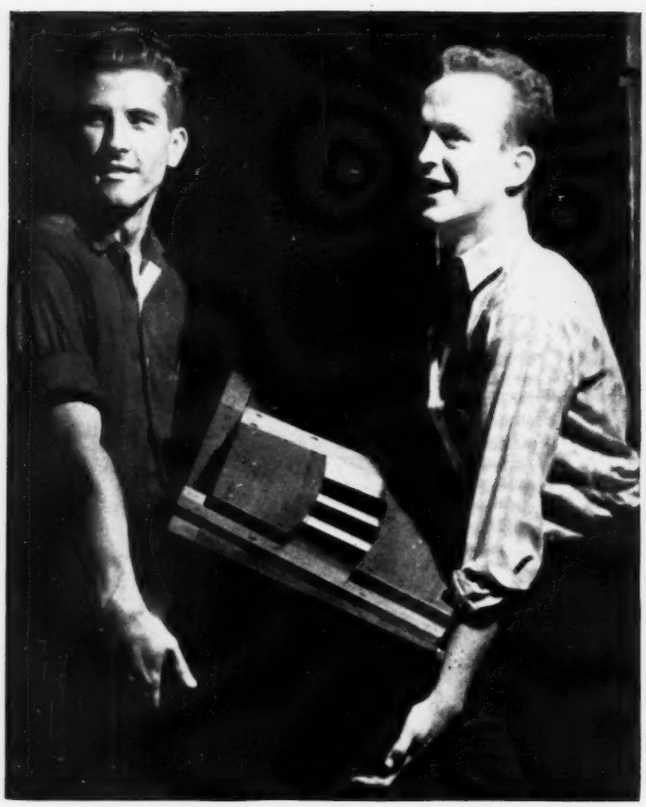
Container Corp. of America, Chicago, Ill.
85,000 lbs./hr. 450 lbs.—604°F

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • AIR HEATERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

before purchasing Boiler or Fuel Burning Equipment



1. Young General Electric engineers bring a wooden model of a nozzle assembly section into the air test lab. The full-size circle from which this block was modeled has a diameter of 8 ft

2. The model is clamped securely to the test stand and air is pushed through the nozzles at velocities up to 1200 mph to approximate the actual speed of steam flowing through turbines

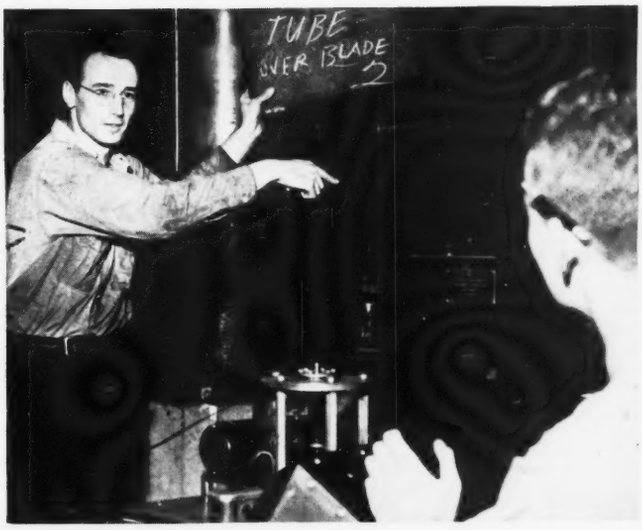
SUPER STREAMLINING

3. The impact-tube "finger" is poised over one of the nozzles prior to a test. When the air stream through the nozzles reaches desired velocity, the impact tube will be moved automatically over the partition surfaces. Engineer points to the leaving edge of a partition, where small eddy losses are to be minimized

UNLIKE THE AUTOMOBILE, train or airplane, steam turbines require inside, not outside, streamlining. Through some of these machines, steam is expanded at speeds up to 1200 mph, more than 12 times the speed of a hurricane.

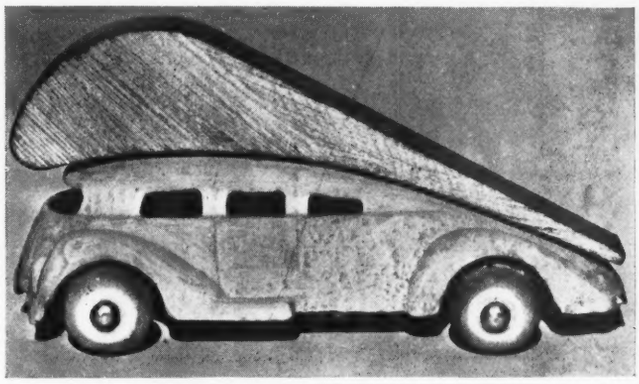
Inside a turbine, velocity energy of the steam is harnessed by a series of bucket wheels, which squeeze as much as 90% of the available energy out of the steam speed through them. To do this, the bucket wheels must have the steam directed at them at just the right angle by nozzles which control the flow, but do not retard the velocity, of the fast-moving steam.

Turbine engineers have streamlined nozzles to the point where they absorb less than 2% of the velocity energy of steam traveling through a turbine. This better than 98% streamlining efficiency is the result of a 20-year study of aerodynamics which began accidentally. In 1920, a General Electric executive had difficulty visualizing the appearance of a turbine nozzle shown on a drawing. He ordered a wooden model of the nozzle section, and then someone suggested that something might be learned by blowing air through it. Through curiosity, a young engineer stuck his finger into the air stream emerging from the model, found he could actually feel air pockets in some spots. Result was development of a special lab for testing nozzles; photographs on these two pages show how the job is done today.



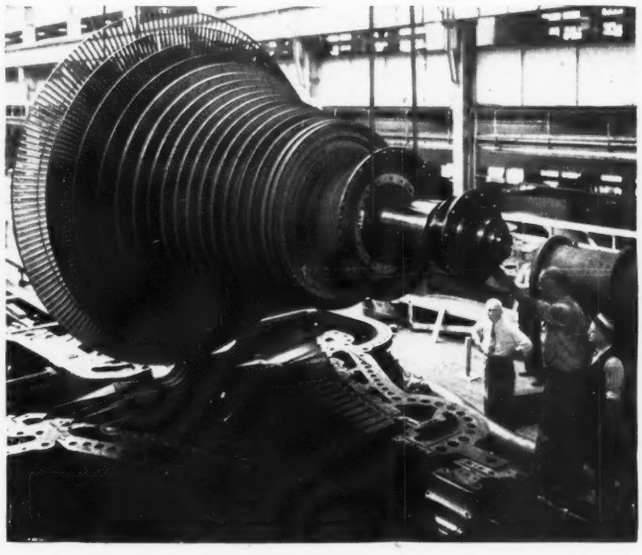
4. Sign language is the only means of conversation once the test is under way. Noise reaches a level 35 decibels louder than the noisiest spot at Niagara Falls—you can't hear yourself yell

5. Zig-zag lines recorded automatically on a strip chart make it easy for the engineers to check efficiency of nozzle streamlining



6. Turbine engineers early found out that "tear drop" design obtained the best streamlining. This nozzle-partition cross section atop an ultra-streamlined toy automobile was designed in 1921, 10 years before motor cars began to "go modern"

7. Here are the "fingers" of streamlined research. Like an airplane's pitot tube, these impact tubes have small tip openings through which air pressure is transmitted to the recording machine



8. This rotor being fitted into the bottom half of a 75,000-kw turbine casing has 17 bucket wheels. The streamlined nozzles in diaphragms secured in the casing are placed so that they direct steam at leading edge of the buckets

Sizing Traps

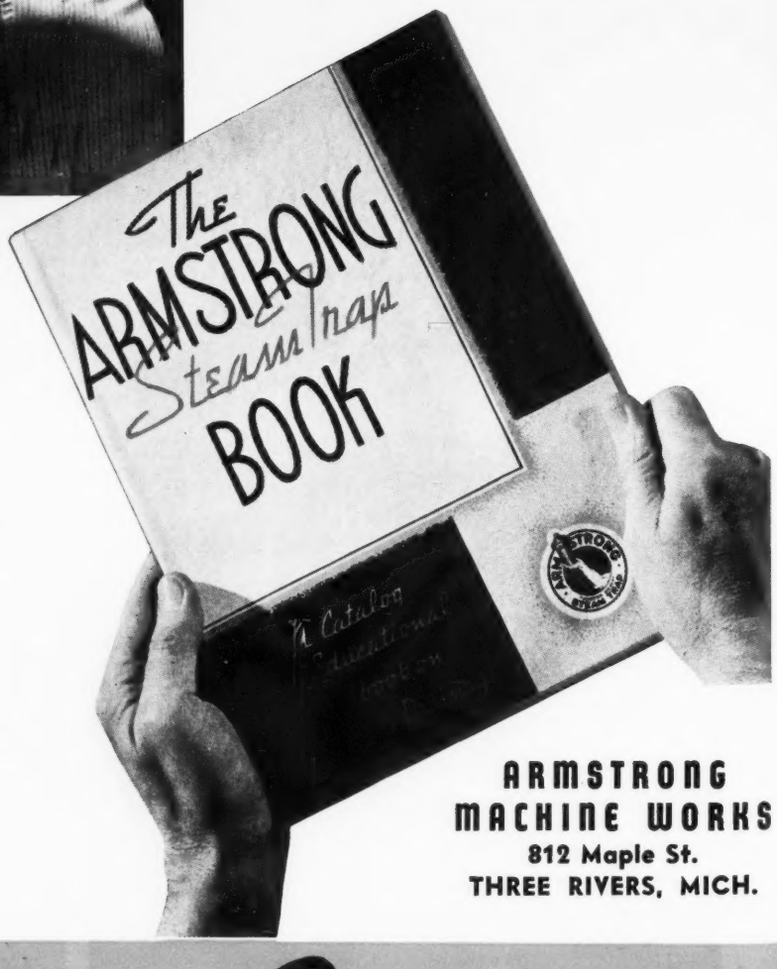
IT'S EASY to get a good installation every time when you use Armstrong traps! One of the fundamental reasons for this is that Armstrong gives you a concrete starting point: COMPLETE CAPACITY CURVES. These curves have been plotted painstakingly from hundreds of actual tests with HOT CONDENSATE and with the normal amount of pipe fittings in lines to and from trap.

The Armstrong Capacity Chart is unique in that you can tell at a glance what capacity a given size trap will have when operating at any pressure below maximum. Such information is absolutely essential to do an accurate job of sizing traps for unit heaters that operate at two different pressures, for water heaters with thermostatically controlled steam inlet valves, etc.

ASK FOR YOUR COPY OF THIS NEW BOOK!

HERE is a new and larger edition of the well-known Armstrong Catalog and Educational Handbook on Condensate Drainage. This 36 page handy reference volume is a veritable encyclopedia of useful information about condensate drainage, heating, pipe sizes, hook-ups, and traps — profusely illustrated with photographs and diagrams and sprinkled with charts and tables.

We will be glad to mail you a copy on request and without obligating you in any way. Copies can also be obtained from your local Armstrong Representative.



ARMSTRONG MACHINE WORKS
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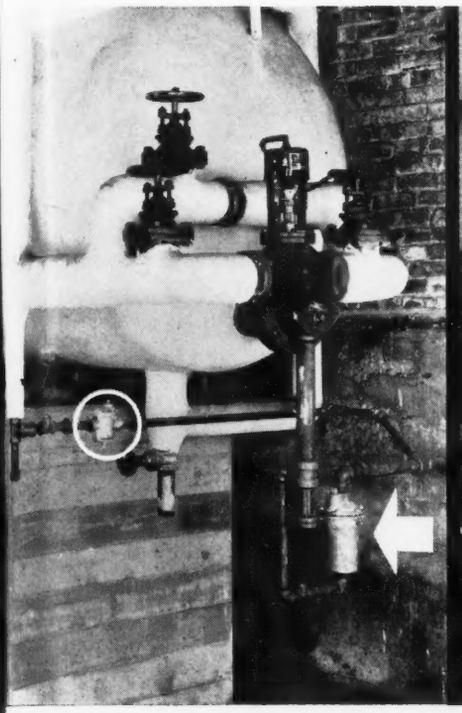
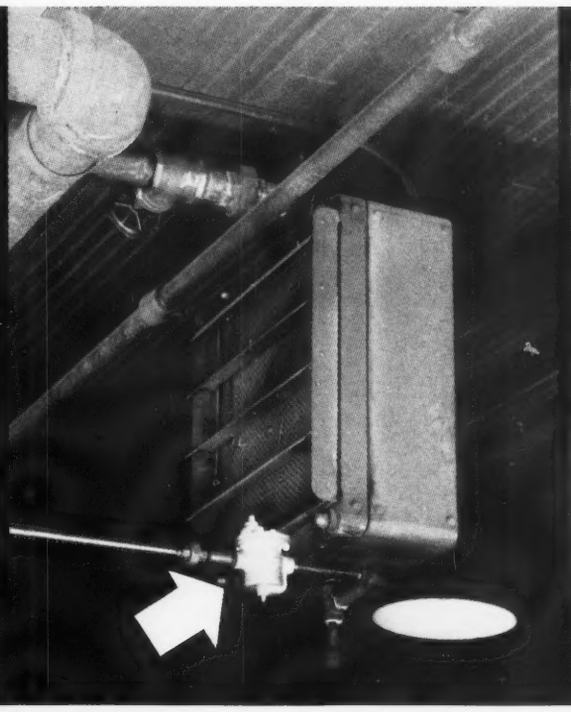
THREE RIVERS, MICH.

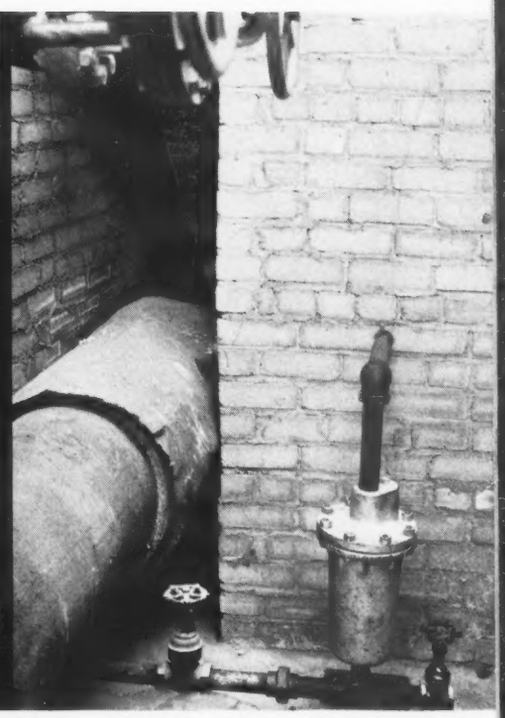
ARMSTRONG "INVERTED BUCKET" STEAM TRAP

"Helping Industry"

the Armstrong Way:







A WATER HEATER

EXAMPLE: Table A on page 26 of The Armstrong Book gives basic data on condensation in submerged coils. From this, it is determined that the maximum rate of condensation will not exceed 600 lbs. per hour, but in order to guard against danger of water-hammer damaging the coils, a safety factor of 3 to 1 is recommended.

The heater is supplied with steam at 40 lbs. pressure but the thermostatically controlled inlet valve throttles it down so that the actual outlet pressure might be as low as 15 lbs. on the trap.

The next step is to find the trap on the Armstrong Capacity Chart with continuous flow capacity for 1800 lbs. of condensate (3 x 600) at 15 lbs. pressure, but with a valve that will open at 40 lbs. pressure. The chart shows that Trap No. 213 will do the job.

The small No. 200 trap shown in the above picture drains the supply line, which is a wise precaution on this kind of an installation.

A UNIT HEATER

EXAMPLE: A heating contractor has the job of installing a unit heater to operate with 5 lbs. steam pressure in the daytime and 50 lbs. at night. The heater has a rating of 75,000 B.T.U. with 2 lbs. steam pressure and 60 deg. entering air temperature.

From Table A on page 25 in the Armstrong Book, the contractor can determine the B.T.U. capacity of this heater for any steam pressure. For 5 lbs., the figure is 75,000 x 1.05, or 78,750 B.T.U. For 50 lbs. it is 75,000 x 1.5, or 112,500 B.T.U.

Referring to Table C on the same page, it is seen that a No. 200 trap for 50 lbs. pressure has capacity enough to handle any load within this range; therefore, this is the size to use.

Where only one pressure is used, Table B should be consulted. If the heater is at the end of a long steam supply line, specify a blast type bucket for the trap

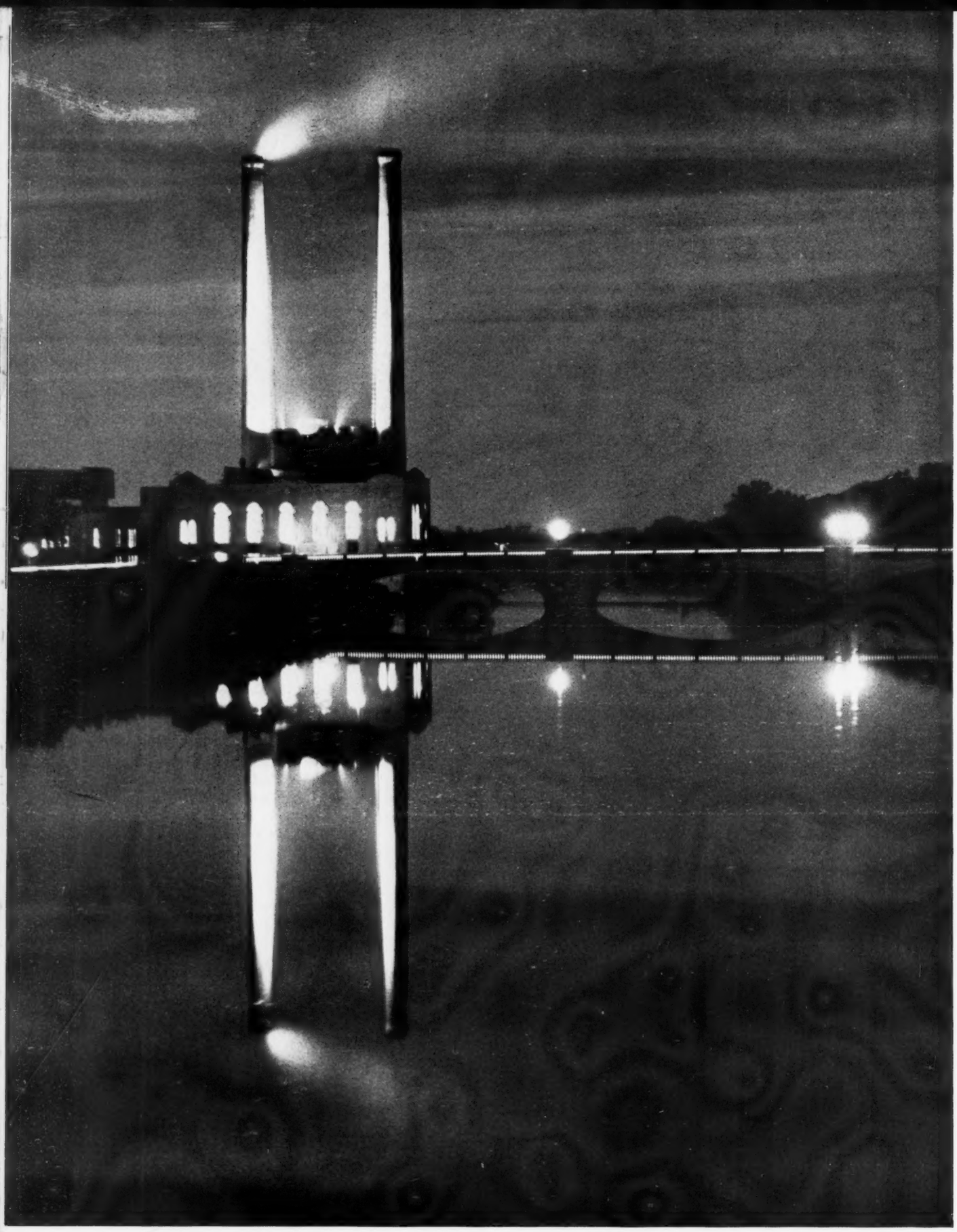
A STEAM MAIN

EXAMPLE: A chief engineer has a 12 inch main supplying steam at 50 lbs. pressure to a processing department 175 ft. from the boiler house. He wants to drain all condensate from the main just before it enters the processing department. As the pipe is well insulated, the peak condensate load will come from warming up the pipe, itself, each morning when steam is turned on. The trap must be big enough to handle this peak load.

Table A on page 21 in the Armstrong Book shows 1.42 lbs. of steam condensed for each foot of 12 inch pipe heated through a temperature rise of 228 deg. F. For 175 ft. of pipe, the total condensate is 248.5 lbs.

It is recommended that the warming up period be considered as 5 minutes. Thus, condensation is at the rate of $(248.5 \div 5) \times 60$, or 2982 lbs. per hour. With a safety factor of 2 to 1, the Armstrong Capacity Chart shows that a No. 214 trap should be selected.

Deliver the Goods!"



Night of Light

Although the lights have gone out all over Europe, not so in America. Beautiful to see is the brilliantly illuminated University of Iowa power plant reflected in the mirror surface of the Iowa River. This photograph was taken by a 17-year-old boy on a moonlight night at ten-minute exposure.

THE OPERATING ENGINEER

George Edwards
Advisory Editor

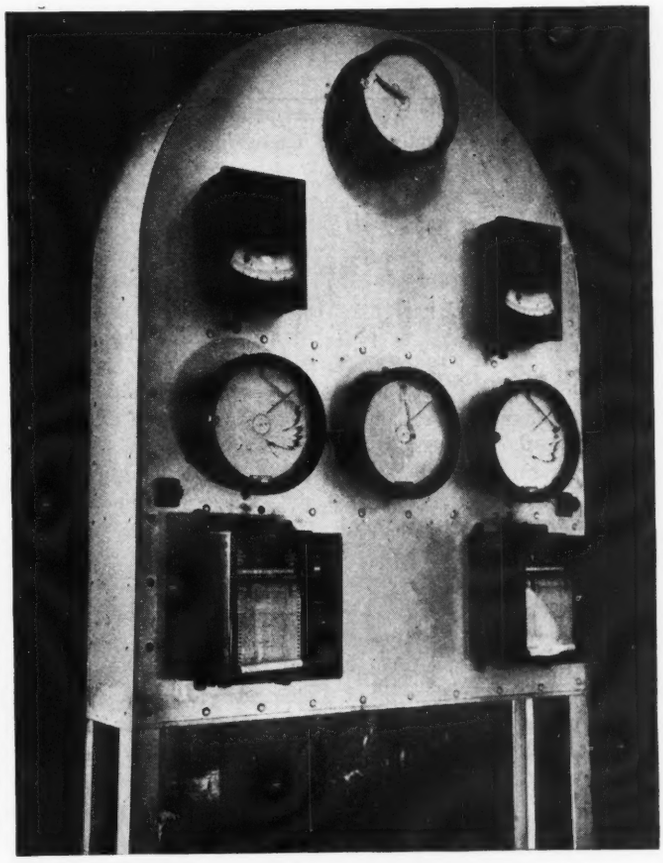
Practical Aids
Maintenance Hints
Questions — Answers

Published monthly as an integral part of POWER

MODEST MODERNIZATION
Boosts Boiler Efficiency 15%

By rebuilding boiler furnaces and installing pulverized-coal firing, boiler capacity is increased 20%, efficiency 15%, and brickwork maintenance reduced by $500 a year. Savings will pay for change-over in three years

By C C HARRINGTON



Meters furnish data essential to intelligent boiler operation

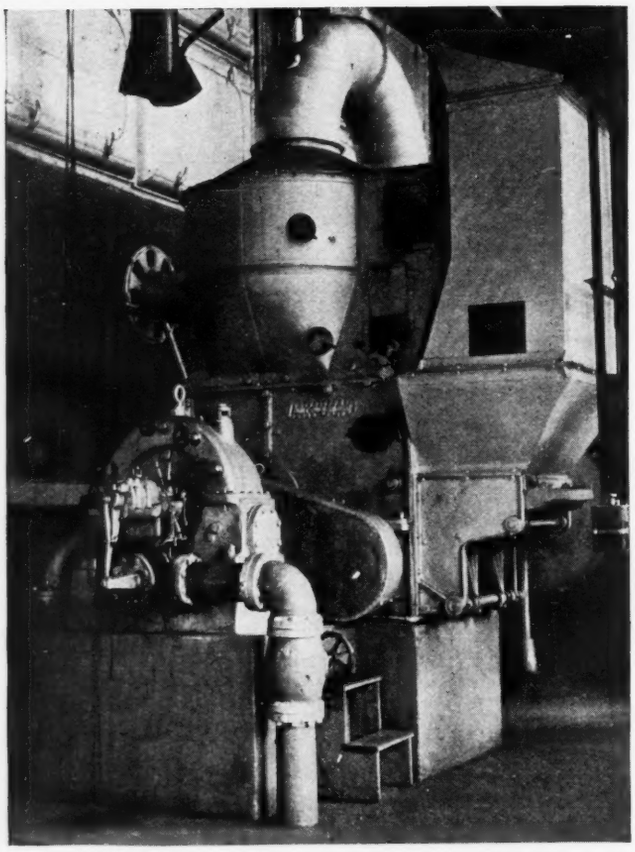
THE AVERAGE PLANT cannot afford to go in for high-priced face-lifting, but experience at the boiler house of the Surpass Leather Co, Philadelphia, shows that modest modernization pays solid dividends.

Recent changes there have permitted the company to keep its old boilers and at the same time increase steam capacity to take care of greater load demands from its tannery. The same revamping job has reduced boiler maintenance costs, greatly improved boiler efficiency and performance.

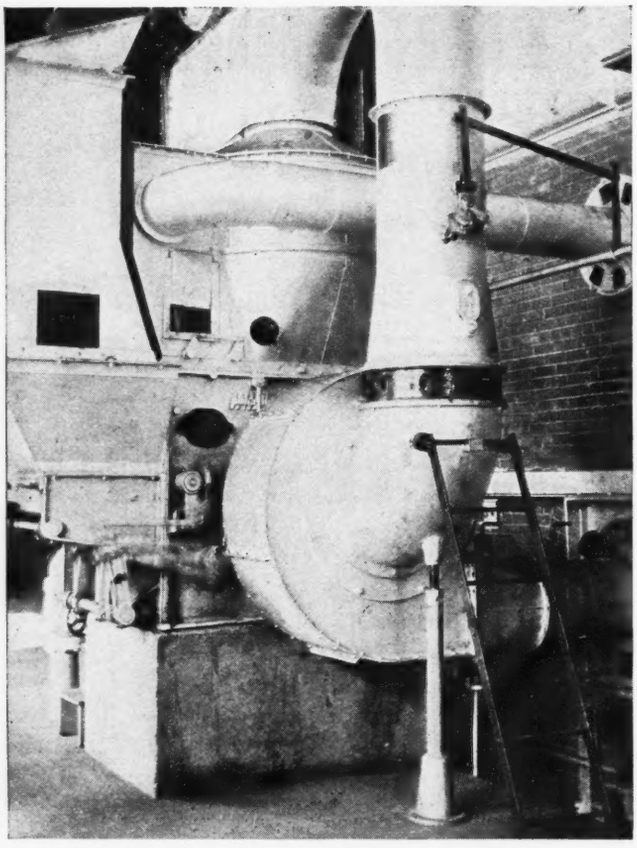
Old Units Costly

The Surpass boiler plant has three straight-tube units generating steam for process and power. With 5000 sq ft of heating surface, each boiler, before revamping, had a maximum capacity of between 30,000 and 35,000 lb of steam per hr (about 200% rating) at an average yearly efficiency of 66%. Boiler maintenance was high, particularly repairs to brickwork.

Studies made by D W Bolton, plant engineer, and the MacKenzie Engineering Co made them decide to equip two boilers for pulverized-coal firing and to enlarge furnace volume for increased steaming capacity. One boiler was



Steam-turbine-driven pulverizer gives each boiler an operating range of 6000 to 42,000 lb of steam per hr



Pulverizers provide fuel-burning versatility by handling any coal within economic transportation distance of the plant

changed at a time in order not to interrupt tannery operation.

In changing to pulverized-coal firing, each bridge wall was moved back to form a new rear wall and a large air duct underneath the furnace floor was removed to increase furnace volume to 2350 cu ft. The revamped boilers were to be rated 37,500 lb of steam per hour, which would require a heat release of 21,500 Btu per cu ft, considered too great for a full refractory furnace. Accordingly, each boiler was provided with a single outside waterwall with 300 sq ft heating area, which will permit a future increase in boiler capacity by adding an additional waterwall on opposite sides of the furnaces.

A turbine-driven pulverizer with a capacity of 4000 lb of coal per hour fires each boiler. These pulverizers are designed to handle any grade of coal used in the Philadelphia area, thereby permitting the engineer to select the most economical grade at any time. By installing slightly larger blades on the built-in fans of the pulverizers, their capacity can be increased to 4500 lb of coal per hour, which makes it possible to handle a future increase in boiler capacity.

Each pulverizer, driven by a 75-hp steam turbine, will handle a 7-to-1 load range on its boiler, from 6000 to 42,000 lb of steam per hour. Coal is trucked to the plant and stored in underground pits. During wet weather, these pits become very damp so that the pulverizers were designed to grind 20%-moisture coal.

The existing overhead coal larry and scales used for the stokers were modified for the pulverizers and the stoker of the third boiler, which operates only when one of the revamped units is down for cleaning.

Combustion Control

About 75% of air necessary for combustion is blown into the furnaces with the coal, which permits good combustion control by a single damper in each pulverizer outlet. During parallel operation of the boilers, these two dampers are mechanically connected together so that the master pressure regulator, actuated by main-header steam pressure, operates both dampers together. This gives instant control of coal-air flow into each boiler with every change in steam pressure, and automatically divides the load change between the boilers. In addition, this permits easy control of CO_2, which averages around 13%. The mechanical connection between dampers is opened when one boiler is used alone. An uptake damper on each boiler is regulated by furnace-draft control.

Boiler performance is recorded by a complete set of instruments mounted on a panel board opposite the boilers. These include a CO_2 meter, flue-gas pyrometer, furnace-draft indicator and flowmeter. Other flowmeters measure the feedwater and distribution of steam for various purposes.

The revamped boilers have increased evaporation from 9.2 lb to 10.6 lb of steam per lb of coal. Yearly boiler and furnace efficiency now averages 76% instead of 66 (an increase of 10 points, or 15%), in spite of the fact that both boilers are on the line in the daytime and only one at night. Although this puts a severe strain on brickwork, furnace maintenance has been reduced $500 per year on the revamped pulverized-coal-fired boilers.

To date, cost of pulverizer maintenance amounts to about one cent per net ton of coal handled. Before the change-over, it took a man an hour per day to remove clinkers and ashes from each boiler. Under the new method of operating, all ash is removed in a few minutes once each week. Savings in fuel and maintenance indicate that this revamped job will pay for itself inside of three years.

Take it From
A TROUBLE SHOOTER

BY L G HUMPHREY JR
Buffalo Forge Co

Many things make fans go wrong—but most troubles can be avoided at the start. These scraps from a service engineer's notebook tell how to keep the "doctor" away

IN SPITE OF EVERYTHING that designers do to make fans foolproof, there are still plenty of trouble calls. That's where the trouble-shooter comes in—his job is to spot what's wrong, fix it, and take steps to see that it doesn't happen again. For every really big job, like a loose bearing, or a wrecked wheel, there are hundreds where some little defect in installation or operation has everybody standing on their heads until it's straightened out. Most of these troubles can be avoided—so maybe if I pick a few from my notebook, I can show you how to stay out of trouble. It's not a case of "what to do 'til the doctor comes"; it's "what to do so the doctor won't come".

Speeding to Trouble

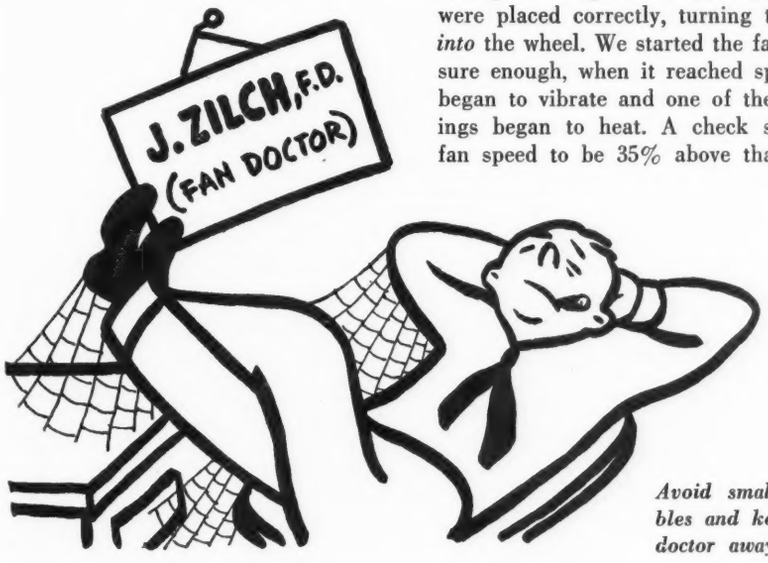
October 12. Another holiday shot. Mr Brown of the Go-Thru Freight Co reported trouble this morning with a new ventilating fan (just 3 weeks old).

Some fans make good dust collectors but it's smarter not to use them that way

The fan vibrated slightly at the start, he said, but Saturday it began to really go to town, and the bearings ran a little hot. As final payment had to be made in a few days, Mr Brown wanted the trouble spotted, pronto!

First look, everything seemed OK. The wheel ran the right way, the fan set tight on a good foundation, guards were placed correctly, turning the air *into* the wheel. We started the fan, and sure enough, when it reached speed it began to vibrate and one of the bearings began to heat. A check showed fan speed to be 35% above that estimated at the factory—this being a special unit.

Questioned, Mr Brown remembered that the contractor had decided to increase the amount of air to be handled and had nonchalantly changed the sheaves and used a larger motor. He had forgotten to check the critical speed of the shaft and the unit had been running in the first critical speed, with vibration and a scored bearing as the penalty. Cutting the speed slightly and replacing the worn bearing fixed things up, as the shaft was in perfect shape.



Avoid small troubles and keep the doctor away

Soot Doesn't Suit

November 14. Had a call from Mr Radiant of the Staydry Roofing Co. A large fan he bought wasn't giving the capacity it should. His maintenance man had found the unit was only taking half its rated horsepower and so had speeded it up slightly and changed to a smaller motor. However, when the fan was started up after this change, it didn't deliver as much air as before. Everything was in fine shape, according to Mr Radiant, and he thought

something was wrong with the wheel or system.

This turned out to be an easy one. When I got there, the plant was running about 10% faster than rated and a check showed that capacity was definitely low, but static pressure was OK. The fan dried roofing paper after the wet pulp had been placed on large steam rolls. Pulp fed continuously to the rolls, the air from the fan being used to dry out the moisture.

The heaters were clean and until the inspection doors were opened, it looked as if the fan was in perfect condition. Not so, however. It was an old forward-curved wheel unit and the blades were reasonably efficient soot collectors—there was about ⅜-in. coating them. What's more, the bottom of the housing was filled over 4 in. deep. No wonder the fan didn't deliver!

I advised Mr Radiant to put back the original sheaves and the larger motor and to clean the fan thoroughly. He said he would, letting us know the results in a couple of days. No doubt about it, the fan came up to capacity—but someone started the fan after it was cleaned and before the sheaves and motor were replaced. Price — one burned-out motor.

As luck would have it, the dirt on the blades didn't throw the fan out of balance. This has happened, however. Remember to clean fans in spots where dust and dirt can gather.

Hot Gas—Bent Shaft

June 11. Last night I left for Paducah to try to cure some trouble on a large high-temperature fan. One of a battery of four, this particular unit was vibrating. My information was scanty but pointed to lack of balance or a bent shaft.

Arriving on the job about noon, I started my usual checkup. The foundation bolts were OK, with plenty of room left for expansion. The wheel looked in perfect condition and the bearings were lined-up properly and securely fastened to their pedestals. The drive wasn't at fault.

We started the unit and there sure was plenty of vibration. My first feeling was that the wheel was unbalanced. However, a check of the shaft with a shaft indicator showed that it had been bent—how I couldn't figure out at first. After talking it over, I learned that the fan had operated fine up to Friday and that trouble had cropped up Saturday. Further questioning brought out the fact that a new man had filled in on the Friday crew, and had charge of the fan.

When I asked this green man how he had shut the fan down, he answered that all he had done was pull the switch when the process was finished. That was all I needed to know. The foreman on the job had forgotten to tell him to run the fan about an hour after the process was complete, to give the fan a chance to cool down gradually, without harm. By shutting down right away, he had left the fan standing in gas running about 1400 F, for about half an hour. The shaft had taken a permanent set, and vibration set in. We replaced the shaft and all was well.

Which Way to Turn?

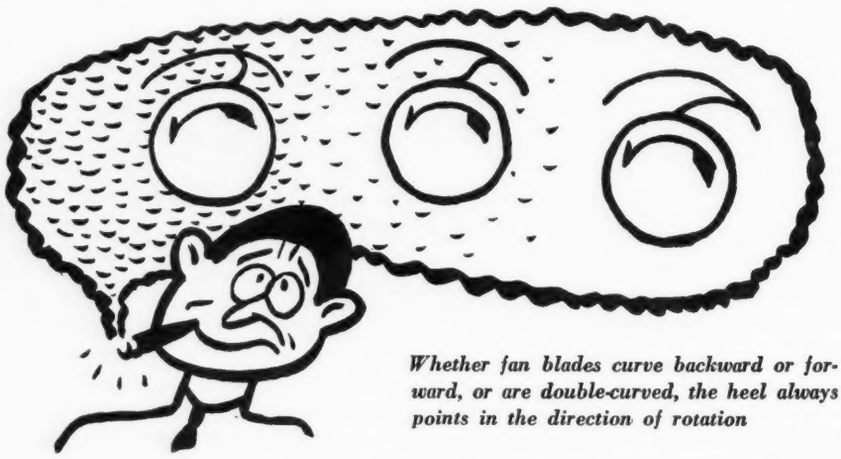
April 16. This morning the erection man of Quick Contracting Co called to unload some trouble they were having with the new fans for the Union Railroad Station. Two of the new fans were taking about 50% more power than rated and the cfm and static pressure were way down. Bill, the erector, had checked and double-checked with the blueprints but still didn't know what was wrong and needed help.

First glance showed that several of the fans were the same size and that they didn't all rotate the same way. However, I followed my usual routine (that's the secret of successful trouble-shooting) and started with the foundation and bolts and then the bearings. Guards and wheels lined up correctly, as far as clearance went, and the wheel was in first-class shape.

I told them to start it up and before the shaft had turned a dozen times I saw one cause for the trouble. The wheel was running backwards and the inlet guards were set for the right rotation. A glance at the next fan, after it was started, made me sure of my "diagnosis" as that, too, was going backward. Somehow, someone had mixed the wheels of these fans and put them in the wrong housings.

It was an easy job to fix things up, but before I left the erection man and I had a little powwow, with me passing out some tips on wheel "hands". I didn't want to get called out on the same kind of job again! Here's what I told him: Wheel rotation is generally marked on each wheel as well as each housing. Sometimes these marks get indistinct or blurred, but if you remember one rule, you can't go wrong, marks or no marks. As most engineers know, there are three kinds of fan blades: forward-curved, backward-curved, and double curved. A lot of engineers never stopped to realize that no matter what the blade shape is, the heel of the blade *always* points forward in the direction of rotation.

Another troublemaker, tied-in with blade rotation, is the business of placing inlet guards. Once the wheel is set to turn the right way, the vanes should be set so they send the air into the blades the same way the fan turns. This means they work with the wheel and increase the efficiency of the fan.



Whether fan blades curve backward or forward, or are double-curved, the heel always points in the direction of rotation

I could go on like this, taking actual cases from my notebook, but I think we've seen enough to sum up a few rules trouble-shooters go by:

1. Start from the ground and work up, checking everything on the way.
2. Don't take anything for granted —check things yourself.
3. Remember haste makes waste—an old saw, but dead right when trying to spot and cure trouble.

The big things for the fan user to remember are: check with the manufacturer before increasing fan speed, abide by the maker's advice on oil for bearings, etc, and, above all, don't try to redesign the unit to fit your own taste. The manufacturer has a staff of slide-rule pushers and fan experts working all the time to make better fans, and you can be sure you'll hear about it when something good pops up.

How to Repair
HIGH-PRESSURE LINES
Without Shutdown

By combining mechanics and welding, pipeline leaks can be stopped in a jiffy

ANY KIND of a piping-system leak is bad, but when this leak occurs in a high-pressure line, it is really serious. This is particularly true if the line cannot be bypassed so that repairs can be readily made. If bypassing is impossible, usually the only thing left is a shutdown, and every operating engineer knows only too well the embarrassing situations that accompany unexpected shutdowns.

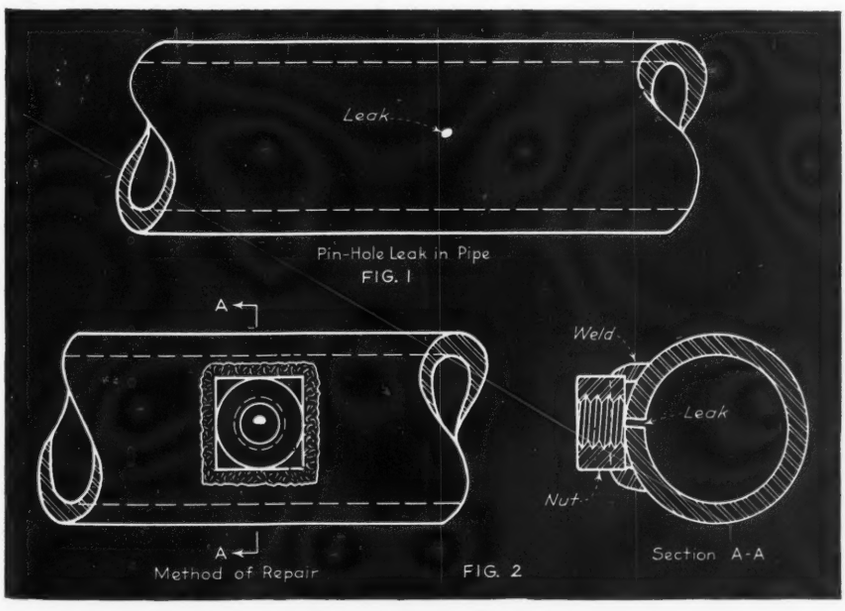
When welding of high-pressure lines became accepted practice, many believed that some of the worries connected with leaks would vanish. However, operators ran into trouble when they tried to make repairs without shutting down.

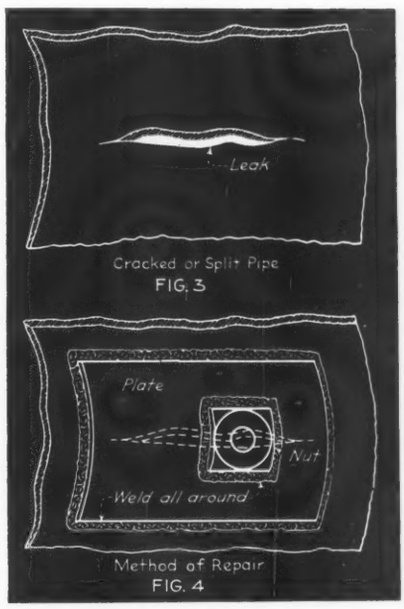
Oxy-acetylene welding was unsuited for making such repairs for several reasons, the two most common being: (1) Cooling effect of the medium being carried by the pipeline usually prevented fusion of weld metal to the pipe, and (2) if it was possible to heat the pipe to fusion temperature, there was extreme danger of the weakened pipe "blowing out," resulting in even more serious trouble.

Metallic arc welding, on the other hand, did not present these two serious difficulties, but nevertheless it was nearly impossible to repair a leak by this method. In attempting to weld a patch on a pipe, the usual experience was that the patch could be welded in place except for the final closing of the weld. Then, nearly every attempt to complete the weld was futile, because pressure would build up under the patch and blow away the final sealing drop of weld metal. The leak was still present, but at the edge of the patch.

Now, however, difficulties have been overcome by combining mechanics with welding. To close a pin-hole leak, Fig. 1, weld an ordinary machine bolt nut over the leak. This permits any water, air, etc, to escape through the hole in the nut during welding, making it possible to complete the weld.

The result is the simple yet effective patch shown in Fig. 2. To stop the leak is simply a matter of screwing a bolt into the nut with sealing compound.





A cracked or split pipe, see Fig. 3, can be closed in the same way. In this case, size of the leak is usually too large to be covered by a nut, so a piece of plate stock is used for the patch. Always cut a small hole in the plate after it has been shaped to the pipe. Then weld a nut over the hole and weld the plate to the pipe, see Fig. 4.

Although this type of repair is usually used only as a temporary measure, it can be considered permanent if the bolt is welded in the nut.

The repairs described here have been used a great deal to stop leaks in high-pressure air and water lines. I know of no reason why the same methods cannot be used on lines carrying other gases or liquids, providing there is no safety hazard. Such a hazard might exist in attempting repairs on steam and other lines which might result in burns or other injuries to workmen.

PRACTICAL AIDS TO OPERATION

Extension Lamps Fitted to the Job

Too FREQUENTLY, extension lamps are stepchildren about the plant. We long ago decided that this is bad business. We use heavy lamp guards that will take a 100 watt lamp. These guards have a substantial hook in one end, with which to hang them up out on the job. The other end of the guards is securely attached to a man-size handle.

The extension cords are heavily insulated with rubber and have rubber-insulated attachment plugs. Cords are made just long enough to be wound upon the guard, see photo. To wind the cord on the guard, we start at the hook end and wind back toward the handle. When the cord is completely wound up, the free end is looped around the end going to the handle, as shown. When a man picks up the lamp, he doesn't have to worry about where the extension cord is or who may trip over it. These lamps are not only strong and convenient to handle, but they give the workmen plenty of light on the job.

New York, N. Y. WILLIAM DEVAUGHN

Give Piston Rings Expansion Clearance

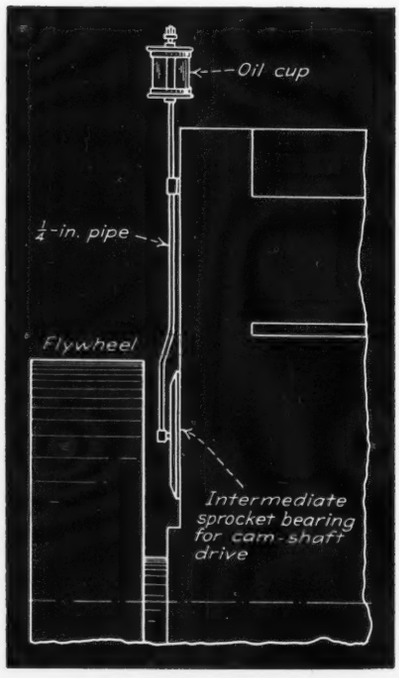
A LARGE UNIFLOW ENGINE operating on 150 lb, 515-F steam gave trouble because of noisy operation. One Sunday, we pulled the piston and found six piston rings broken into short pieces. The color of the cylinder wall and worn condition of the rings pointed to improper lubrication. This we figured was caused by the rings not having sufficient clearance between their ends to permit them to expand without putting excessive pressure on the cylinder wall.

I learned that the old rings had been given only 1/16-in. clearance when they were installed. The new rings were placed in the cylinder and found to have the same clearance between their ends as the old ones. To make sure that they would not become too tight in the cylinder and scrape off the lubricant, I cut another ¼ in. off them. After that the engine gave no further trouble.

Butte, Mont. C O HAGAN

Oil Cup Solves Lubrication Problem

A BALL REARING burned out on the intermediate sprocket for chain-driven camshaft on one of our 300-hp gas



engines. This bearing is normally splashed oiled, but oil entering from one partially exposed side of the bearing was not sufficient. As shown in the figure, this bearing is between the flywheel and end of the engine with small space between the two to provide additional lubrication.

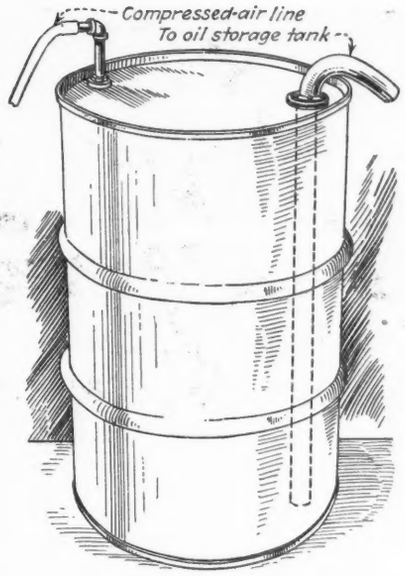
We solved the problem by drilling and tapping a hole through the bearing cover and extending a ¼-in. pipe up from this hole to above the rocker arms. On the upper end of the pipe we put a glass-body cup oiler. This oiler is filled each time we oil the camshaft and fill the rocker cups. We installed the oil cup over two years ago and since then have had no further trouble with the bearing.

Shiprock, N. Mex. JAMES F MAHER

Compressed Air Empties Oil Drums

COMPRESSED AIR has made emptying of oil drums both an easy and a clean job in our plant. The figure shows how it's done.

We drilled a ¾-in. hole through a 2-in. plug for the oil drum drainage hole. On the bottom of the plug we attached a piece of ¾-in. pipe that extends nearly to the bottom of the tank, when the plug is in place. On the top side of the plug a curved piece of pipe is attached that discharges into the receiving opening of the storage tank. We also drilled a regular plug for the air-relief hole in the top of the oil drum for



a ¼-in. nipple, on which to make a compressed-air connection.

Now, to empty a drum of oil, we place it alongside of the storage tank, remove the plugs, put in our special fittings, connect the air line, turn on the air and watch the oil flow. The drum has to be tipped slightly toward the storage tank so that the last remaining oil will collect around the drain pipe and be forced out by the air. Where air is taken from a high-pressure source, open the air valve only enough to maintain an easy flow of oil from the drum.

Riverdale, N. Y. ALEX GRAY
Chief Engr, Colored Orphan Asylum

Electric Clocks Measure Compressed-Air Flow

TO GET A FAIRLY ACCURATE ESTIMATE of the output of two 1750-cfm motor-operated air compressors, we investigated several methods. To keep the cost down, we selected a system of electric clocks. The compressors operate from no load to full load by quarter stages, depending on air demand. At no load, four pockets, held open by springs (two on either end of the cylinder), enlarge piston clearance so that little if any air is discharged when all four pockets are open. As the air requirements increase, pressure drops slightly and the governor closes one pocket after another, depending on the demand.

We use ¼-in. air guns, connected into each of the 4 pipes from the governor to the unloading pockets, to make electrical contact and start a clock on each

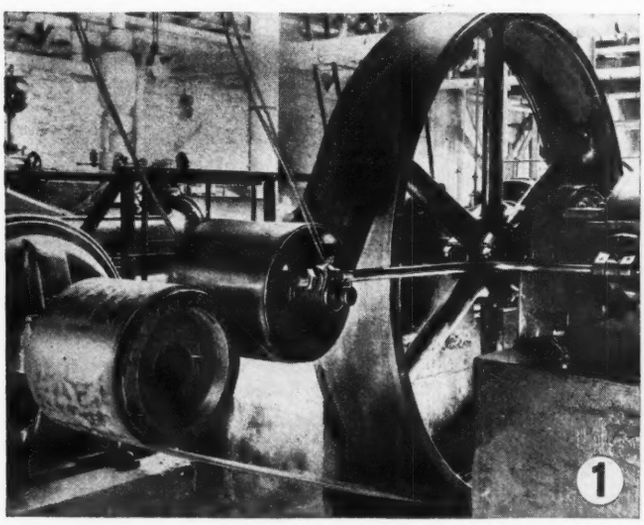
Modernizing Eliminates Belt Trouble

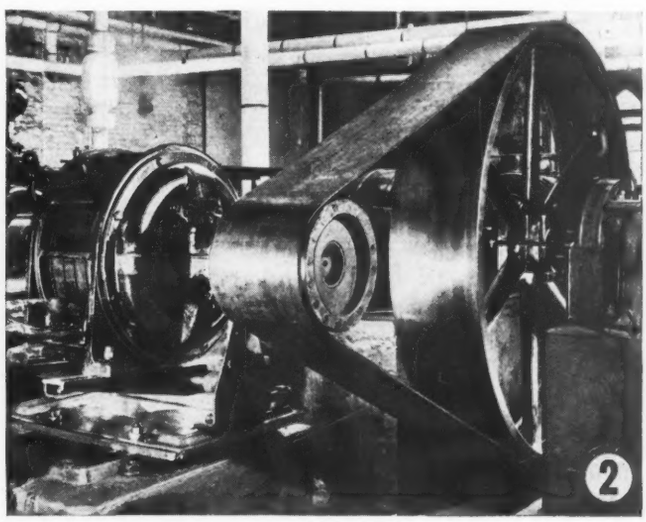
NOT SO LONG AGO, an idler pulley was about the only answer to a short-center belt drive. If it gave trouble you just had to worry along with it some way. These old standbys still have their place, properly applied. In many applications, however, a lot of trouble can be eliminated by replacing them with an open drive, and mounting the motor on a base to maintain automatically correct tension in the belt. This proved to be true on one of our flat-belt drives. that had seen considerable service.

This drive consisted of a 15-in. leather belt connecting a 100-hp, 865-rpm induction motor to an air compressor. The belt ran on a 16.5-in. motor pulley and 84-in. compressor flywheel and operated on 6-ft, 8-in. centers, Fig. 1. The gravity idler, 17-in. in diameter, was only 4.5 in. away from the motor pulley, a distance far too short for good operation, and belt replacements were quite frequent.

Fig. 2 shows how the idler was removed and the motor mounted on a tension base, using a shorter belt to compensate for the slack taken up by the idler. Making this change eliminated all the former troubles with this drive, another testimony that it pays to modernize.

Philadelphia, Pa. R O SPENCER





of the four quarters as the load on the compressor picks up. The 4 clocks are wired so that when the half-load clock starts, the quarter-load clock stops and so on to full load. A small green lamp mounted over each clock lights when its circuit closes, so that compressor load can be determined at a glance. A fifth clock connected to the motor circuit runs whenever the compressor operates and gives total time. As we know the time each compressor operates at the various loads, we can make a close estimate of the amount used.

Rochester, N. Y. H P KING

Repairs Pump With Metal Spray

WE HAVE A VOLUTE PUMP on which the wearing rings became badly worn. To repair these rings, we put the rotor into a lathe and lightly grooved the wearing surfaces of the rings with a sharp tool. Then we built up the rings by metal spraying, doing the job slowly to prevent over-heating the impeller and warping it. Sprayed metal machines easily; after the spraying was completed, it was a simple matter to turn the ring in the lathe to a good fit.

After six months service from the pump since its runner was repaired, I am convinced that its efficiency is back to normal. The repair job was done at a cost of about $15.00 compared to $265.00 for a new impeller and rings.

Harvey, N. D. ORVILLE HOKSCH

Homecast Lead Gaskets and Valve Seats

THE FIGURES show a mold that we have found handy for making lead gaskets and valve seats for our ammonia refrigerating system. We made it from two old cast-iron plates from a brick-forming press. In one block we machined grooves to give us the size gaskets and valve seats needed, Fig. 2. After this, the top surface of the block was ground true and holes drilled to tap the grooves, as shown. One surface of the second block we ground true to match finished surface of the other.

When in use, the two blocks are held together by C-clamps, Fig. 1, and heated with a blow torch before pouring the lead into the grooves. Where a sufficient number of grooves cannot be cut in one block, they may be cut in both and the back of one block used to seal the face of the other.

Marissa, Ill. GEORGE BLUM

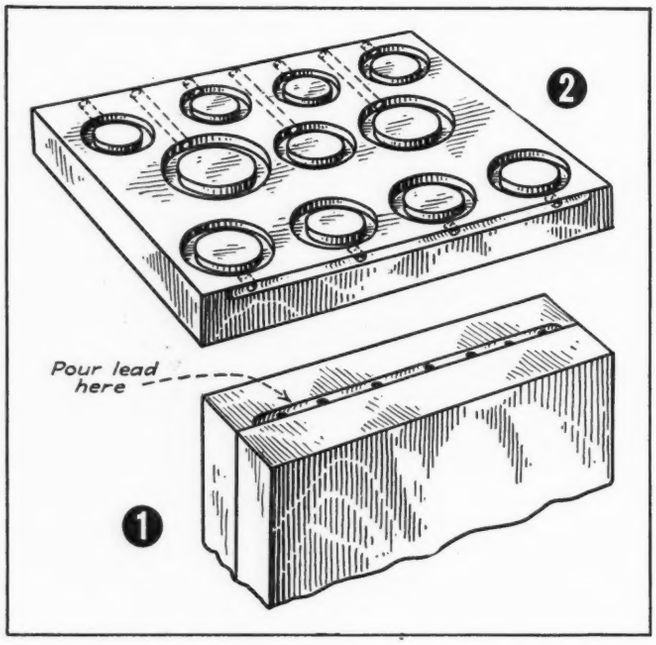
Air Operation Cures Switch Trouble

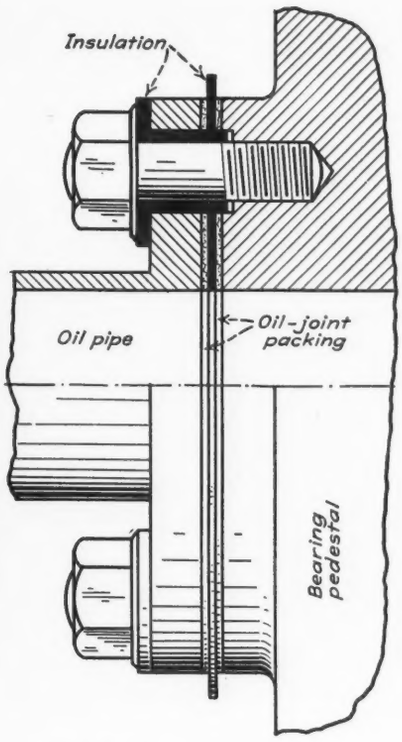
STEEL-MILL FLAG SWITCHES undergo severe treatment and are frequently the source of considerable trouble. In one plant these switches were operated by the rolled bar passing over and depressing a trigger. The switches gave trouble and their triggers scratched the bars. To eliminate both troubles, a water-operated switch was devised.

On each switch a ⅛x1-in. flat-iron lever *B* was attached to its movable arm, see photo. A circular piece of sheet metal *A* attached to the outer end of the lever was hit by a water jet coming through hole *H*, to keep the lever in a raised position. When a rolled bar passed over the jet the lever dropped and closed the switch.

After using the water-jet for a while we discovered that it left water marks on the bars and the water created an objectionable condition. We solved this problem by using a jet of compressed air instead of water. This little kink has other applications than the one mentioned and is a good one for maintenance men to keep in mind.

Latonia, Ky. DANA GIBSON





Insulated Oil-Pipe Joint Stops Sludging

EXCESSIVE SLUDGING of turbine-generator lubricating oil is frequently caused by electric currents passing through the oil film in the bearings. The film is so thin that a few volts is enough to break it down and produce excessive sludging. All generators should have one pedestal completely insulated from the bedplate, to prevent the passage of stray currents through the oil film.

Lubricating oil sludged on one of our turbine-alternators which had a supposedly insulated bearing pedestal. A 1/8-in. Bakelite sheet under the pedestal and bushings of the same material on the bolts insulated the pedestal, but the oil-pipe-flange connection to the bearing, shown in the photo, had been overlooked. We tried a variety of materials in the joint, but failed to find one that gave a satisfactory oil-tight and insulated joint.

We eventually licked the problem by making the joint as in the drawing. A 1/32-in. thick ring of Bakelite composition, larger in diameter than the oil-pipe flange, provides the electrical insulation. Oil tightness is obtained by a 1/32-in. oil-joint packing, the same diameter as the pipe flange, on each side of the insulation. Studs were insulated with bushings turned from solid Bakelite composition and the joint was made up with oil-resisting varnish.

Newcastle-on-Tyne, England J D OSWALD

Aluminum Disk Adapts Meter for Hot Water

WE USE an ordinary disk-type water meter to measure cold-water makeup entering the surge tank of our boiler-feed system. This meter gave no trouble until we installed a continuous blowoff, then it gradually lost accuracy and finally failed to register at all. When the meter was opened, we found that the hard-rubber rotating disk was badly distorted, presumably by the heat transferred to the makeup water.

Relocating the meter on the cold-water side of the heat exchanger was considered, but was found to be impractical. Finally, we decided to replace the hard-rubber disk with one made of aluminum, turned out in our own machine shop. Since installing this disk and checking the meter by a measured volume of water to determine the very slight correction factor required for accurate readings, its operation has been satisfactory.

Lynchburg, Va. O M ROBERTS

Squirrel-Cage Motors Come up to Speed Better

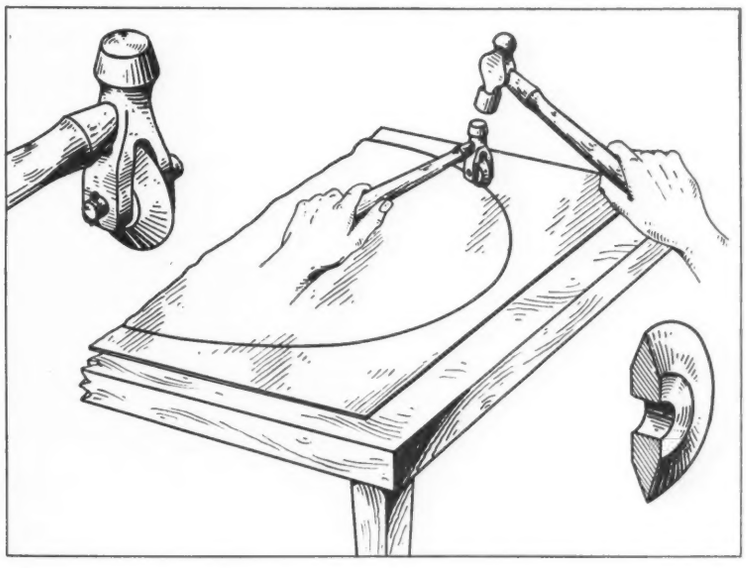
Poor connections between rotor bars and end rings have always been the cause of squirrel-cage induction motors not coming up to full speed, in the many cases of this trouble that I have investigated. If the connections are bolted or riveted, remove the end rings, thoroughly clean their surfaces and the ends of the bar. Then, reassemble and either silver solder or weld the joints. This requires time, but if the job is done properly, you will have no more trouble with these joints.

Plainfield, N. J. H W HODGSON

Jig Speeds up Sheet-Metal Cutting

THE WHEEL CHISEL, see figure, patterned after the cutter of a pipe-cutting tool, saves our maintenance crew a lot of time in cutting circular shapes from sheet metal. The cutter, ground to an edge and used in a tool steel holder, presents a continuous sharp edge as it is moved along the line of cut. Ruggedly made, it does a better and faster cutting job than can be done with a cold chisel. There is also less danger of the workman giving his knuckles a slap with the hammer.

Penacock, N. H. C H WILEY



READERS' PROBLEMS

Questions for Our Readers

Blowdown Tank Connections

Question 1

WE HAVE *8 hrt boilers, each 72-in. diam by 18 ft long. We want to install a blowoff tank in place of discharging the main blowoff line over the side of a steep bank. We have a steel tank, 5 ft diameter by 20 ft long, that could be used for this purpose. Would it be large enough, and how should we hook it up?*—GAK

Bring Water to Zero Hardness?

Question 2

WE USE CITY WATER *that is treated with alum and lime; we treat the boiler feed with soda ash and trisodium phosphate. Steam pressure is 225 lb. Water from the boiler analyzes as follows: hardness, 50 ppm; P alkalinity, 160 ppm; M alkalinity, 240 ppm. Should we use enough chemicals to bring water to zero hardness?*—COM

SUITABLE answers from readers will be paid for if space is available for publication. Answers accompanied by practical drawings or photographs will command additional pay.

Checking Stretch of Connecting-Rod Bolts

Answers to Nov Question 1

The Question

HOW CAN WE CHECK *the stretch of connecting-rod bolts in our diesel? Also, can we find out if the bolt has been twisted by sledging up?*—KGA

Take Up Carefully

TO AVOID STRETCHING connecting-rod bolts, be sure to take up the nuts evenly and snugly. Putting a length of pipe on the end of the wrench or sledging makes the nuts too tight, causing stretching or even shearing of bolts. Assuming bolts have right tension to begin with, bolts can be marked before removal and brought back to the mark when replaced. However, this won't do after re-babbitting the connecting-rod bearings or when taking up slack in loose bearings.

If nuts are hard to remove from bolts, that may be a sign of twisting. Also, the body of the bolt may show a twist. The threads will give another clue; at the point of twist the threads on one side will be wide apart and on the other side will be almost touching one another. This is why the nut on a twisted bolt is hard to remove.

Philadelphia, Pa. W T MULLEN

Make Measurement Easy

THE STRETCH of connecting-rod bolts may be checked by measuring the length with a pair of outside micrometers or calipers. To make measurement easier and to insure accuracy, it is a good idea to drill and countersink a small hole in each end of the bolt and to drive a small round-headed dowel into the hole. The holes should be on a line parallel to the axis of the bolt, and the dowel heads should not extend beyond the ends of the bolt. If this is done, they will form permanent points on which measurements can be made. The sketch shows the general set-up.

Bolt twist can be checked by means of a straight line scribed across each end of the bolt, as nearly parallel as possible. After the bolt has been snugged up, measure distance from each end of each line to any flat permanent surface. After final tightening, repeat the measurements and a comparison will show whether the nut end of the bolt has turned more than the head; whether or not the bolt has been twisted.

Port Arthur, Texas J B RAINEY

Use Micrometer

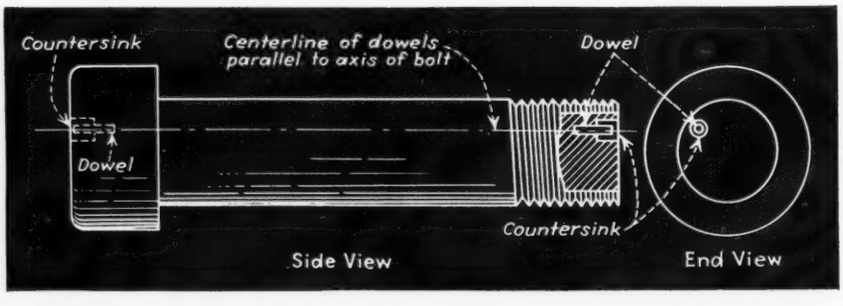
THE BEST WAY to check the stretch of connecting-rod bolts while taking up on them, is by "miking" the bolt before it is under stress and then while taking up. To find out how much the bolt should be elongated, the operator should get the information for his particular engine from its maker. If unable to do this, and if his engine has been running satisfactorily under the old setting, he can get good results by "miking" the bolts before loosening and after they have been removed. The average of the elongations found on the connecting-rod bolts in the engine will be somewhere near the right answer.

There are wrenches on the market that indicate the amount of pressure applied to them, but friction of the threads differs from bolt to bolt and so makes it difficult to get as accurate results as by the micrometer method, if carefully applied.

To check the twist of a bolt is difficult in the bearing, but easy if the bolt is removed. Take a straight edge and check the diameter at short intervals along the length, using the micrometer. Check the pitch of the threads at several points and compare the readings.

I believe a bolt will twist to some extent, when put under stress caused by taking up on the nut, but I don't think this needs to be considered when tightening up, for it is likely that the twisting effect will be in ratio to the elongation.

Bismarck, N. D. LESLIE BRADLEY



Can Calculate Twist

SINCE IT IS HARD to measure twist while the bolt is in the connecting-rod bearing, it might be simpler and as accurate to calculate it from the elongation. This latter can be measured with a C-gage and a set of feeler gages.

The following example will show the method of calculating the angular deflection. Proper figures can be gotten from any strength of materials handbook. Assume a 1-in. diam bolt, with an area of 0.785 sq in. Length from center of bolt to center of nut is 2 in. Elongation after pulling up is 0.005 in.

$$\text{Modulus of elasticity} = \frac{\text{Stress}}{\text{Strain}}$$

$$32{,}000{,}000 = \frac{F \div 0.785}{0.005 \div 2}$$

$$F = 63{,}000 \text{ lb}$$

Since the tension in the bolt must equal the compression in the nut, the frictional force equals the force times the coefficient of friction, or

$$F_1 = 63{,}000 \times 0.4 = 25{,}200 \text{ lb}$$

This coefficient of friction is based on clean dry surfaces, and will vary for an oiled surface.

Using a thread with a lead of 1:8, the tangent of the lead angle is 0.125. The force perpendicular to the bolt due to the lead on the threads is

$$63{,}000 \times 0.125 = 7{,}900 \text{ lb}$$

Total force perpendicular to the bolt is 25,200 + 7,900 = 33,100 lb. This is the total twisting force on the bolt, exerted in pulling it tight.

$$\text{Torque} = \text{Force} \times \text{Radius} = 33{,}100 \times 0.5 = 16{,}550 \text{ in. lb}$$

$$\text{Angular deflection} = \frac{2 \times \text{torque} \times \text{length}}{\pi\,(\text{radius})^4\, n}$$

where n = modulus of rigidity = 15,000,000

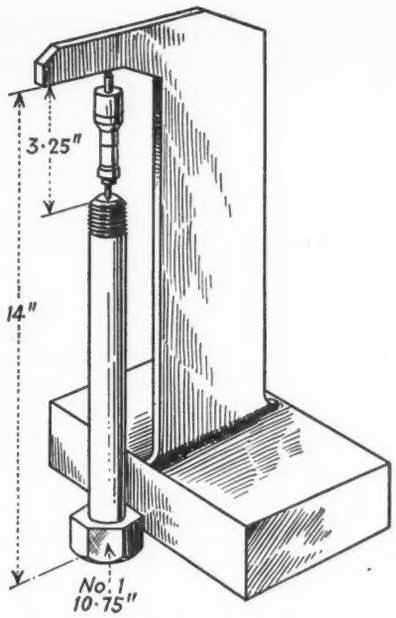
$$\text{Angular deflection} = \frac{2 \times 16{,}500 \times 2}{\pi\,(0.5)^4 \times 15{,}000{,}000} = 0.0225 \text{ degrees}$$

Since this is little more than one minute, the difficulty of measuring it is evident. While this method makes certain assumptions and omits some minor factors, it is fairly accurate.

Staten Island, N. Y. R ATLAS

Gage Simplifies Work

TO CHECK BOLTS for stretch, use an inside micrometer, with the easily-built gage shown in the sketch. Use a piece of 3x2-in. stock for the base and 2½x ¼-in. for the upright; make the gage



about 3½-in. longer, between machine faces, than the total length of the bolt, including head. Number all bolts and stamp length on head for reference. When checked in the future, any stretch will show clearly.

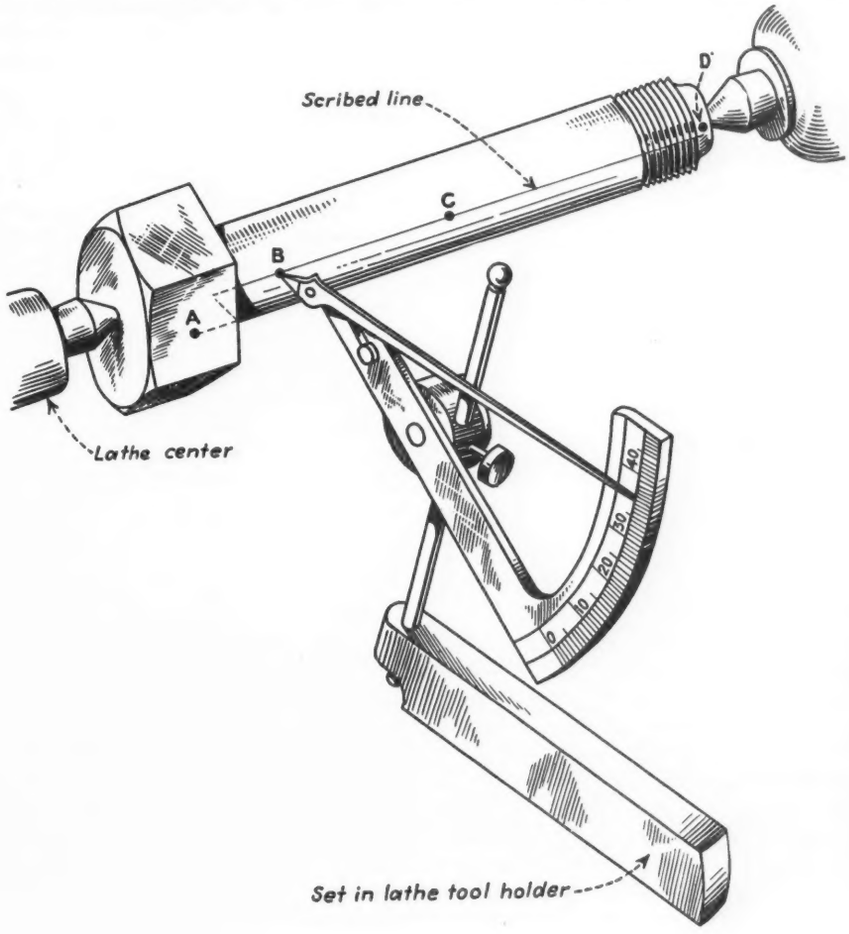
To check for twist, use a machinist's graduated indicator, as applied in lathe work. Have the short end of the lever ground to a fine point. Scribe a straight line along the full length of the bolt, including the head. If convenient, center the bolts in a lathe and use a scriber in the tool holder. Run the slide rest along the full length of the bolt. Use a key-seat rule or scribing block and V-blocks if no lathe is available. Along the scribed line, place several punch marks as shown in the second sketch. When the indicator is applied to these marks it should give the same reading at each, assuming there has been no twist. Any future twist can be checked by another similar set of measurements. Make all measurements at normal room temperature.

Kearny, N. J. GEORGE MCNALLY

George Edwards Summarizes

FOR BIG BOLTS particularly, I like McNally's or Atlas' ways of measuring bolt length. Most plants haven't got outside mikes long enough for the job, but can readily make a C-gage or arm for use with a feeler gage or inside mike. The problem is to write down the lengths and remember where you wrote 'em.

One easy way to scribe an axial line on a bolt (this way of determining twist strikes me as simplest) is to turn a pointed lathe toolbit on its side in the holder, set the bit tip accurately on center (so you can scribe the



bolthead too), then move the crossfeed back, set the bolt on centers, bring the tool back tight against the bolt surface, and scrape a line by moving the carriage back and forth. This line should be centerpunched at intervals.

To check it later, if you have no indicator (which most of us haven't), you can make one out of an 11-in. piece of thin metal strip or wire. Point the ends and put a hole or clamp exactly 1 in. from one end. Bend another piece into an L that fits into the toolholder, and fasten on the arm so it can swing. Then stick up a strip at the outer end of the pointer and put the short end against the bolt; any deflection will be magnified ten times. — GEORGE EDWARDS.

Cleaning Gage Glass

Answers to Nov Question 2

The Question

WHAT IS A GOOD WAY *to clean a water glass on a low-pressure boiler without removing the glass tube?*—LCM

Coffee Cup Plus Muriatic

POUR about 1 in. of muriatic acid into a cheap coffee cup and fill with hot water. Next raise about 2 lb pressure in the boiler and close both water-gage cocks. Open the bottom cock and the top cock; water in the glass will be blown out.

While closing the top valve, submerge the petcock into the solution in the cup. When the valve is closed, a vacuum is created in the glass, and the liquid will flow in. With the petcock still in the solution, operate the top valve; this will cause the acid solution to bob up and down in the glass, causing all rust, oil and other stains to flow out. The dirtier the glass, the more acid required.

Jamaica, N. Y. V HARRON

Suggests Offset Glass

WHERE LOW OR MEDIUM pressures are encountered, it is comparatively easy to change over the water glass so as to permit swabbing or cleaning of the inside of the glass without dismantling. To do this job, LCM has only to turn the usual ball-check angle cocks from the vertical position to one where the branches are horizontal. To these valves, we connect the new hookup: two 1x½x1-in. tees, carried on nipples from the valves. The facing ends of the tees are undercut at the bottom to provide packing space and glands are improvised from ¾x1-in. hex bushings which have been bored out to fit loosely over the gage glass.

With the gage glass held in place with the two stuffing boxes, we close the open ends of the tees with plugs and the system is ready for the valves to be opened. When the glass fouls, we can close off the cocks, remove one or both plugs and swab the glass until clean. If the glass fouls often, it may be advisable to replace the lower plug with a gate valve, having a free passage large enough to admit a cleaning swab.

A further safeguard is a strap around the branches of the two tees, tying them together and preventing steam pressure from opening the hookup and possibly causing blowout or rupture of the glass.

Longview, Texas M T PATE

Use Trisodium Phosphate

RAISE THE BOILER PRESSURE to about 2 lb. Drain glass, close top and bottom gage cocks. Mix a solution of 5 parts hot water and one part trisodium phosphate (or other washing powder, not soapy) in a metal container. Muriatic acid and hot water may be used in obstinate cases but is not recommended because of its effect on rubber washers.

Hold can of solution under open drain cock, submerging cock opening. Open top gage cock, allowing steam to escape into can, then quickly close top cock and solution will rush up into glass. Repeat as often as necessary. All trace of solution may be removed by filling and emptying gage with boiler water, after cleaning glass.

Elmhurst, N. Y. M V MAHONEY

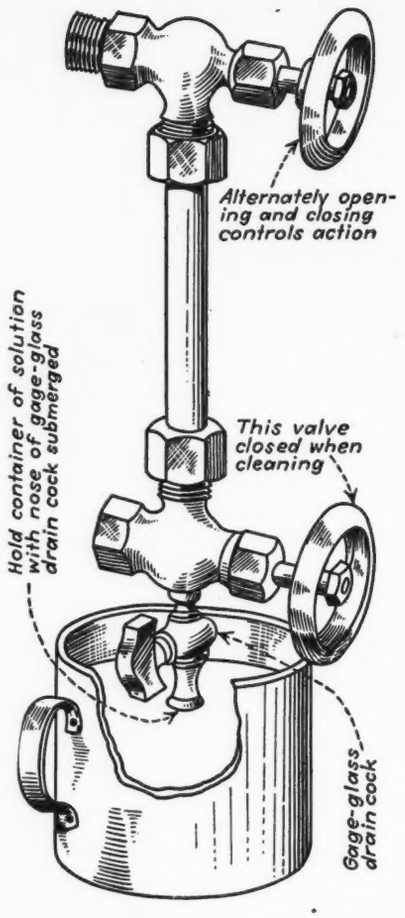
Why Not Buy a New Glass?

GLYCERINE will clean LCM's gage glass if it isn't too badly scaled up. By removing the top plug, the glass can be filled from the top. If the outside of the glass is scaled up it can be cleaned easily by using steel wool and kerosene. I think LCM would save both time and money if he put in a new gage glass.

Chippewa Falls, Wis. A C RINDY

Different Slants on the Same Stunt

APPARENTLY the scheme outlined by Harron, and Mahoney, above, is more or less standard practice. Numerous other readers suggested the same procedure: (1) close top and bottom cocks, (2) open top cock slightly to fill glass with steam, (3) hold cup with solution


Alternately opening and closing controls action
This valve closed when cleaning
Hold container of solution with nose of gage-glass drain cock submerged
Gage-glass drain cock

under drain cock and close top cock quickly, (4) condensing steam in glass forms a vacuum, drawing solution up into glass. We give below some further hints and kinks of this method, taken from letters of readers who suggested it.—GEORGE EDWARDS.

From Hamilton, Ontario, S G PATERSON advises using a tablespoonful of raw muriatic or other acid in a cupful of hot water and points out that the entire operation need not take more than 10 minutes. J M DOWELL, Chicago, Ill., suggests using vinegar and hot water and says it might be well to wear cotton gloves as the cup will get rather hot. J B MCQUEEN of Preston, Idaho, agrees on the general idea but prefers to use a bottle to hold the acid and attaches a short length of rubber hose to the drain cock to reach down into the solution. If acid won't do that trick, try other solvents such as acetone, ether, or carbon tetrachloride.

When handling acid, every precaution must be taken to prevent its coming in contact with the eyes and skin, says S H COLEMAN, Staunton, Va. JT, of Pittsburgh, suggests that if the acid isn't drawn into the glass, the loose gland nuts on the glass should be tightened, as leakage at the nuts has broken the vacuum.

SHORT QUESTIONS AND QUICK ANSWERS

Typical Plant Questions

Q—Name 10 causes of sparking on motor-generator sets.

A—(1) Brushes of improper grade, (2) brushes not fitted to commutator, (3) brushes sticking in holders, (4) brushes not properly spaced around commutator, (5) brushes not on neutral, (6) high mica, (7) high commutator bars, (8) rough commutator, (9) overload, (10) short circuit in field coils.

Q—Show how to find the factor of evaporation.

A—The factor of evaporation, F, is the ratio of (1) the amount of heat actually absorbed by a lb of water from feed temperature to steam conditions to (2) the latent heat of steam at atmospheric pressure. $(F = (H - h)/970.2)$. To find factor of evaporation look up heat content of a lb of steam at boiler working conditions. Subtract from this figure the heat content of water at feed temperature. Both figures can be found in the steam tables. Divide the answer by the latent heat of vaporization at atmospheric pressure, 970.2. The answer is factor of evaporation. Equivalent evaporation can be found by multiplying actual evaporation by factor of evaporation.

Q—Explain the advantages and disadvantages of using pulverized coal.

A—Pulverized coal is suited to large installations, a wide range of coals can be burned successfully, efficiency is high, operation is flexible. A pulverized-coal installation usually requires a greater investment than alternative firing methods, and appreciable power is consumed in pulverizing.

Q—In a horizontal belt, which should be the tight side, top or bottom? Near what pulley, the large or small one, should the idler be placed?

A—If the tight side is put on the bottom, the force of gravity will work on the slack side to increase the arc of contact between belt and pulley, thus increasing effectiveness. The idler pulley should be placed near the smaller pulley and arranged so that its axis tends to rotate about the axis of the pulley. The purpose of the idler is to increase the arc of contact rather than to act as a belt tightener. Increased arc of contact helps most on the small pulley.

Q—Which will give the greater economy in a compound engine, superheated or saturated steam? Why?

A—Superheat reduces cylinder condensation.

Q—In which heater, open or closed, can water be heated to the higher temperature, if steam at 5 lb is available from an engine exhaust?

A—Probably in the open heater. The highest temperature theoretically possible would be the saturation temperature corresponding to the steam pressure at the heater, probably 3 lb, allowing for pressure drop in the connecting piping and for the venting arrangements on the open heater. The open heater will bring the water close to the steam temperature but the average closed heater has a sizable terminal difference (difference between steam and water temperatures). Terminal difference on a closed heater can be reduced by increasing the heating surface, but it is not economical to push this too far.

Q—What is meant by balanced draft? Why is it considered advantageous?

A—Strictly speaking, balanced-draft operation means that furnace pressure is exactly the same as that outside the boiler. However, it is customary to operate at a slight negative pressure (say 0.10 in. water). This method of operation reduces to a minimum leakage of cold air into the furnace and loss of hot gas from the furnace.

Q—What is the minimum effective elevation of a return trap with reference to the boiler it feeds?

A—Since condensate flows to the boiler by gravity when the pressures in boiler and trap body are equalized, the trap must be located at a point above the boiler water line, with enough head to overcome frictional resistance at full flow. Most manufacturers give 3 to 6 ft as the practical minimum.

Q—Which side of a leather belt would you put to the pulley? Why?

A—Most agree on the grain side. Tests indicate that under reasonable shop tensions, the flesh side will transmit only 50 to 60% as much as the grain side, on the average. With high tension, the flesh side will do better, but still less than the grain side. Furthermore, the increase of capacity due to running-in seems to be less on the flesh side.

ARGUMENT CORNER

We Need Apprentices, And How!

I AGREE 100% with your article "We Need Apprentices," December POWER. I belong to the class of chief engineers who have come up from the dirty-hand stage through college to a position of running power plants and trying to direct the efforts of approximately 40 men.

Even though I have gone from farming to school teaching to monkeying with motors to repairing boilers with complete shop work at college, I still feel I could use more experience in performing my daily tasks.

Not only is the experience of handling tools important, but I think you must have worked among men to be able to handle them. A college professor of machine design told me that the biggest job on leaving college would be the human engineering.

How much better it would be if industry as a whole would see the need for apprentices in time and give the boys a chance (Henry Ford is), instead of waiting until the U. S. Government has to step in and possibly set up some form of federal regulation to take care of the deficiency.

Rittman, Ohio U J GRANT

Doctor for Hospital Plants Hits Home

I HAVE BEEN a reader of POWER for many years and nothing has appeared in your magazine which has interested me more or come any nearer to hitting at an actual truth than your article "Hospital Power Plants Need a Doctor," December POWER.

In spite of the wonderful advances in the use and production of steam and electricity, the average plant burning 3000 tons of coal per year, more or less, is no more efficient than it was 30 years ago. This is probably more true of hospital plants than of any other. Many of these plants are less efficient today than when built 30 years ago. Yet it is next to impossible to get a few hundred dollars to spend for improvements which would yield from 50% to 200% on the investment. This is no exaggeration.

I have in mind a particular hospital which consumes about 2000 tons of coal per year and should not under any circumstances use over 1000 tons, yet year after year this institution looks to the local Community Chest for many thousands of dollars to take care of the difference between their income and their operating expenses.

Material corrections could be made in this plant without any major expense and the returns would be most liberal, yet the management has turned a deaf ear to any suggestions.

My business consists of rendering a professional service of an advisory nature to steam plants which consume from 800 tons to 6000 tons of coal per year. After many years of experience in this work and having contacted more than 150 such plants, I am still at a loss to know why this waste goes on.

Twenty-five years ago, if asked, I could have given a very definite answer as to why small plants were so uneefficient. A few years later my answer would have been entirely different. Today I have no answer at all. The efficiency, or inefficiency, of each individual plant seems to be associated with entirely different circumstances with a more or less common result.

I am very glad to know that someone besides myself has recognized the fact that hospital plants as a class are particularly inefficient and I hope that this matter can be given more publicity.

While it is true that my income depends upon the plants which are not 100% efficient, I believe that the general public as well as men of my profession would be better off if a little more knowledge of what should be expected of a pound of coal in furnishing heat, light, refrigeration, etc, be brought home to hospital managements.

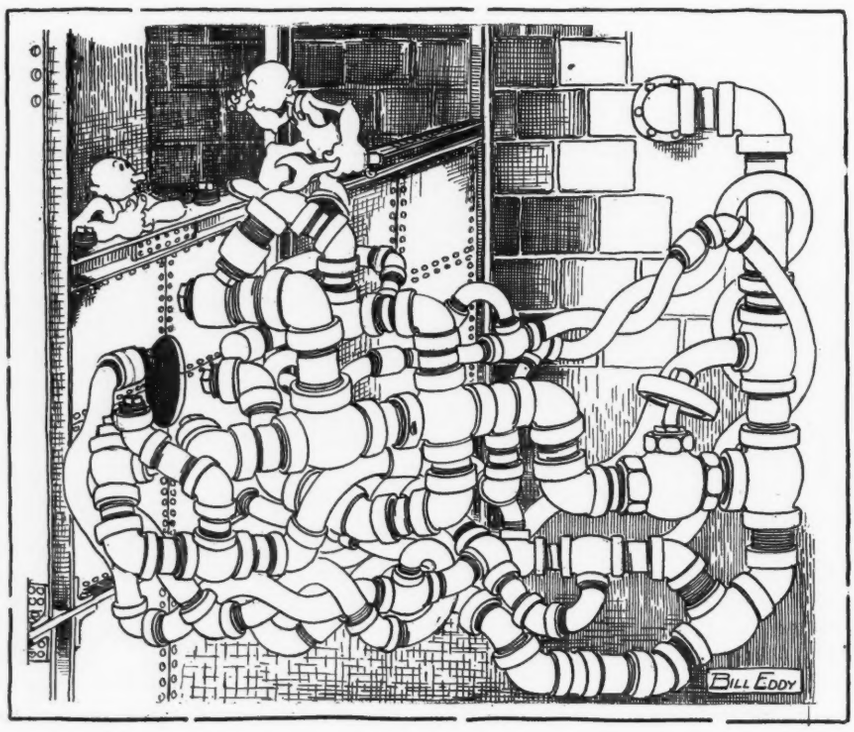
Boston, Mass. C C WATERMAN

Quirk Keeps Motor from Starting

THE ARTICLE "Sometimes a Job Can Be Too Good," by H W Hodgson, October POWER, recalls a pumping installation that gave trouble. The pump was driven by a single-phase ac motor and was about 125 ft from the building supplied with water. At times the motor would refuse to start.

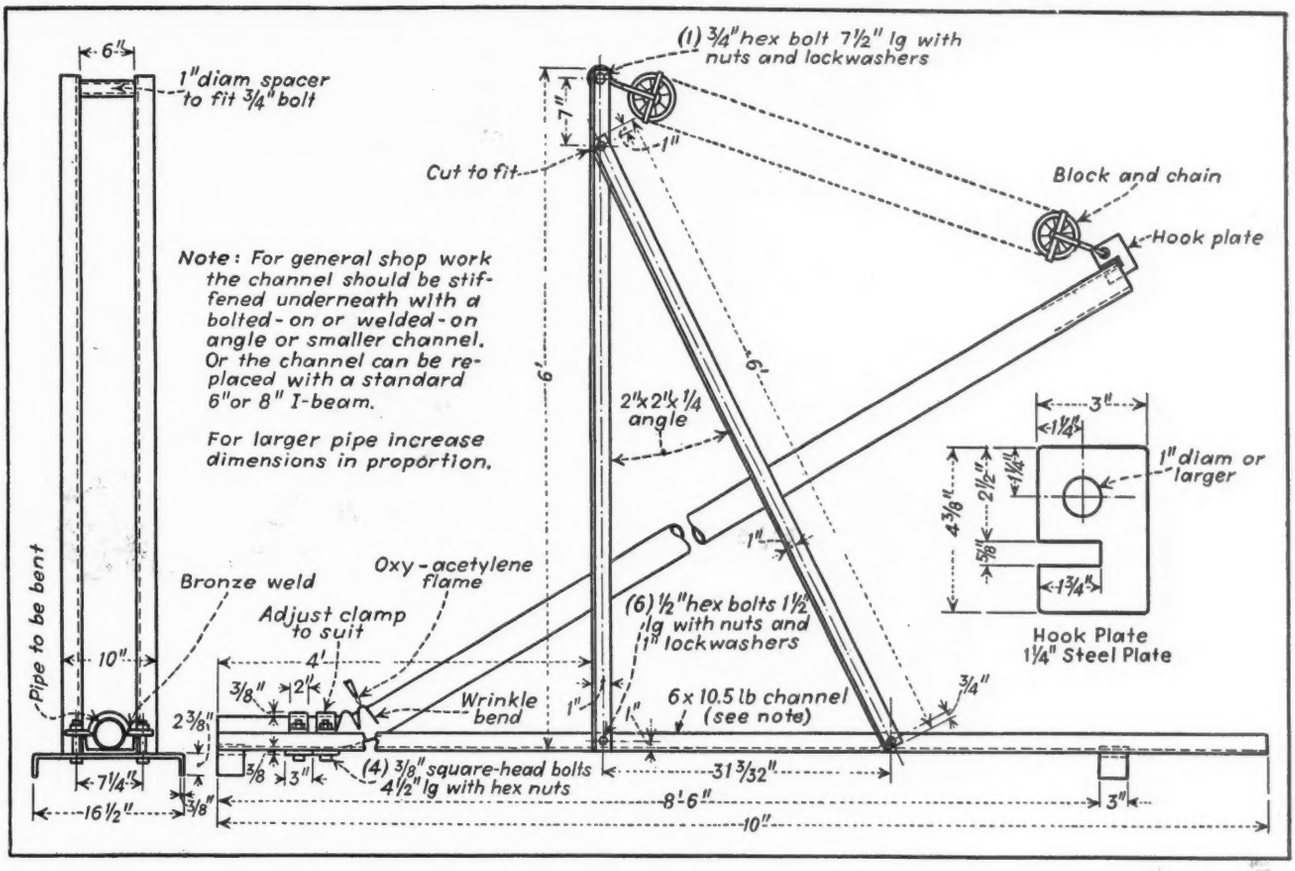
An inspection of the pump, motor and control showed everything in good order. Then it was discovered that each power wire was installed in a separate conduit. The iron conduit around each conductor increased the counter voltage induced in it to where voltage at the motor was scarcely sufficient for starting. Putting two conductors in one conduit cured the trouble.

Ansonia, Conn. W T ESTLICK



Let's try it once more, Homer, and this time keep your eye on the hole!

HOW TO WRINKLE-BEND PIPE



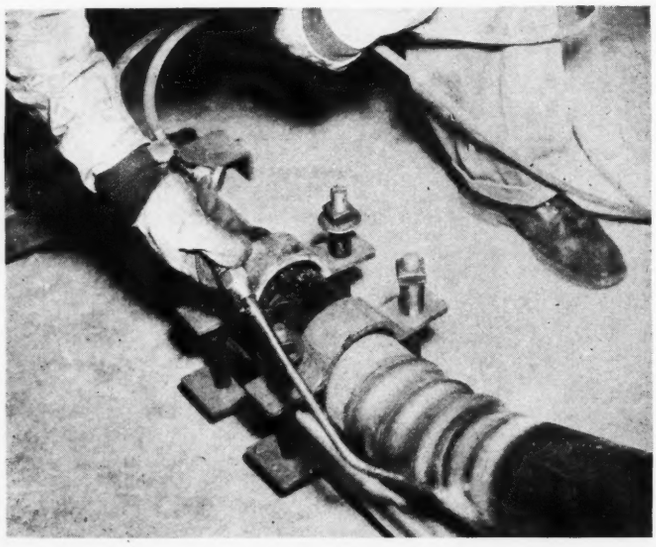
1 With this easy-to-build jig and an oxy-acetylene torch, you can "wrinkle-bend" 2- to 6-in. pipe to any desired angle. All you do is heat one or more narrow bands at right angles to the pipe and extending about ⅔ of the way around. When the section is red hot, bend the pipe, forming a wrinkle on inner side of bend and getting about 10 deg of curvature. You can make a wrinkle in 4-in. pipe in about 2-3 min. Wrinkles project outward, giving full opening throughout the bend; wall thickness stays the same.

2 Clamp pipe just behind point where bend is to begin. Pictures show a 4-in. pipe being wrinkle-bent through 35 deg.

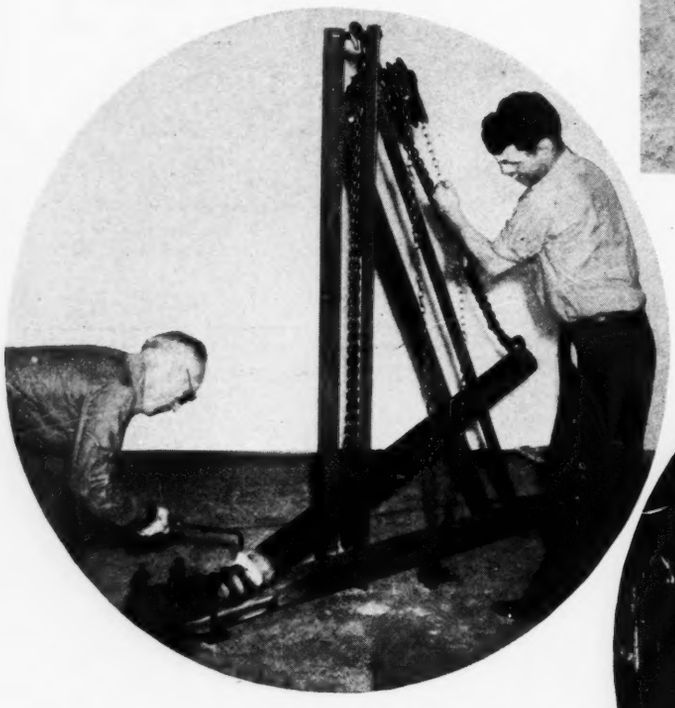
3 Attach chain block to one end of pipe. For long lengths of pipe, put a rope sling around the pipe at a convenient point and attach hook to sling. Blueprint shows how to make a hook plate; if you have a block and chain with a hook like that shown here, you won't need to make one.

HOW TO WRINKLE-BEND PIPE

4 Heat upper ⅔ of pipe by moving blowpipe from side to side. Apply heat evenly. In the picture, the operator is making the last of four wrinkles.



5 When the operator gets a narrow band red hot, he signals his helper. The helper starts to take up slowly and steadily on the chain block. With a little practice, the helper can gage the speed and amount of bending to make a good wrinkle of about 9-11 deg. A large sheet-metal protractor or template might make it easier to see how far to bend.



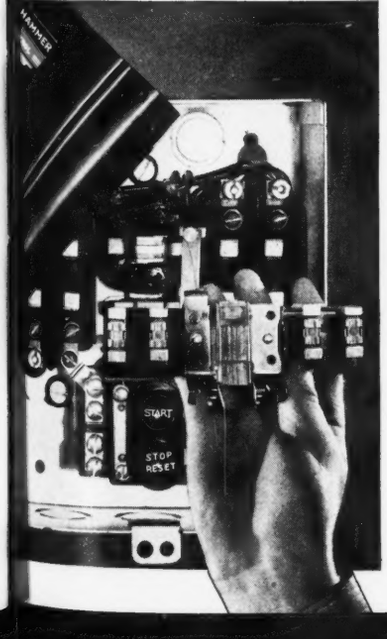
Blueprint, pictures and data furnished by The Linde Air Products Co

6 This picture shows the wrinkle half-formed. Note that the operator keeps playing the blowpipe from side to side until the wrinkle is finished. All the way through the job, remember that even heating of the narrow band means a good wrinkle.

7 Here is the finished bend—not bad for a "home-made job". Four wrinkles, of about 9 deg each, and 2 in. apart, give this smooth 35-deg bend. Best results come from bending about 9-11 deg at a time; wrinkles can be slightly closer together on small pipe, but should be farther apart on large.

The DUST problem

must be solved by the *builder* of your Motor Control



. . . or not at all

Unless the contacts of Motor Control are kept clean you are going to have trouble. Anyone knows that. And anyone who has ever looked inside a Motor Control enclosing case knows it isn't practical to dust off and scrub contacts . . . even if you were willing to spend time and money doing it. So the *dust problem* must be solved by the Motor Control builder—not the user.

Cutler-Hammer engineers realized this years ago and designed *vertical* contacts that *can't* collect dust and grime, that *stay* clean, that last longer, that work better. If you want greater dependability, better performance and lower maintenance in Motor Control you must *insist* on vertical contacts. You do this automatically when you standardize on Cutler-Hammer, the Motor Control that uses *vertical* contacts exclusively. Specify Cutler-Hammer and see the difference. CUTLER-HAMMER, Inc., *Pioneer Electrical Manufacturers,* 1358 St. Paul Avenue, Milwaukee, Wisconsin.

CUTLER-HAMMER
MOTOR CONTROL
C-H

Insist on Dust Safe VERTICAL *Contacts*

Power Lines

New President, Chairman for General Electric Co

Charles E Wilson, executive vice-president, was elected president and Philip D Reed, assistant to the president, was elected chairman of the board of directors of the General Electric Co at the meeting of the directors of the Company in late November. They take over their new responsibilities January 1, succeeding Gerard Swope and Owen D Young, who will become honorary president and honorary chairman of the board, respectively. Charles E Wilson, who began his career in business as an office boy at the age of 13, has been executive vice-president of General Electric since December, 1937. It was a new position when he was appointed to it, after having been vice-president in charge of General Electric's Appliance and Merchandise Department since 1930.

Mr Wilson was born in New York, N. Y., on November 18, 1886. He began working as an office boy in 1899 with Sprague Electric, a former constituent company of General Electric. Since then he has served in practically every function of the business and in many capacities.

He went from office boy to shipping clerk, factory accountant, production manager, and then assistant superintendent of the factory in 1914. Shortly after that he was appointed sales manager. In 1918, the year following transfer of the conduit business from Sprague to General Electric, he became assistant general superintendent of the Maspeth, L. I., and New Kensington, Pa., works.

In 1923 he went to Bridgeport as managing engineer in charge of the conduit and wire business, and two years later he was appointed assistant manager of General Electric's Bridgeport works. Here began his intimate association with the appliance business, and in June, 1928, he became assistant to the vice-president in charge of the Merchandise Department.

During this time Mr Wilson devoted his principal efforts to the manufacturing problems of the department, and in 1930 was appointed manager of the Merchandise Department in charge of engineering, manufacturing and sales. In December of the same year he was elected a vice-president of General Electric, and was one of the original members of the newly formed appliance sales committee of the Company. In 1935 he was assigned the additional responsibility of directing all appliance activities, including refrigerators, electric ranges, and other kitchen appliances, as well as air conditioning equipment.

Philip D Reed, assistant to the president of General Electric since December, 1937, was born in Milwaukee, Wis., on November 16, 1899.

He joined General Electric in its law department in 1926, one day before his 27th birthday. He holds degrees both in electrical engineering and law. He received his engineering degree from the University of Wisconsin in 1921 and his doctor of laws from Fordham University in 1924. He is a member of Tau Beta Pi, honorary engineering society.

Mr Reed's first job began while he was still a law school student, taking evening classes at Fordham, and in 1922, before his graduation, he became vice-president and patent counsel for the Van Heusen Products Co of New York. Before that he was patent solicitor for Pennie, Davis, Marvin & Edmonds of New York, and patent attorney for J M Van Heusen of Boston.

He entered the General Electric Co in 1926 as assistant to vice-president C W Appleton of the Company's Law Department in New York. In 1928 he was transferred to the incandescent lamp department, and from July 1, 1934, until his appointment as assistant to the president in December, 1937, he was general counsel for the lamp department.

Owen D Young (left), former chairman of the board of directors of General Electric, greets his successor, Philip D Reed, and Gerard Swope, former GE president, shakes hands with the new prexy, Charles E Wilson (right). Mr Young has become honorary chairman and Mr Swope honorary president, effective January 1, 1940

Canadian Hydro Progress

A survey of hydroelectric progress in Canada during 1939 shows that considerable activity took place in installation of new generating capacity. New units in 1939 totalled 97,040 hp, which with an installation of 1400 hp omitted from the 1938 review, brings the total for the Dominion of Canada at the end of last year to 8,289,212 hp.

Among the outstanding installations last year was the ninth unit of 53,000 hp, put into service by the Beauharnois Light, Heat and Power Co on the St. Lawrence River.

Rigid Stationary Engineering Tests Asked By Daubenmire

More rigid tests for prospective stationary engineers in the United States were demanded by Carl R Daubenmire of Columbus, Ohio, president of the National Association of Power Engineers, who spoke at a past presidents' meeting of Keystone Lodge No. 16, held in Buffalo, N. Y., December 2.

More than 60 past presidents of the organization, which includes building engineers from all parts of Western New York, were present.

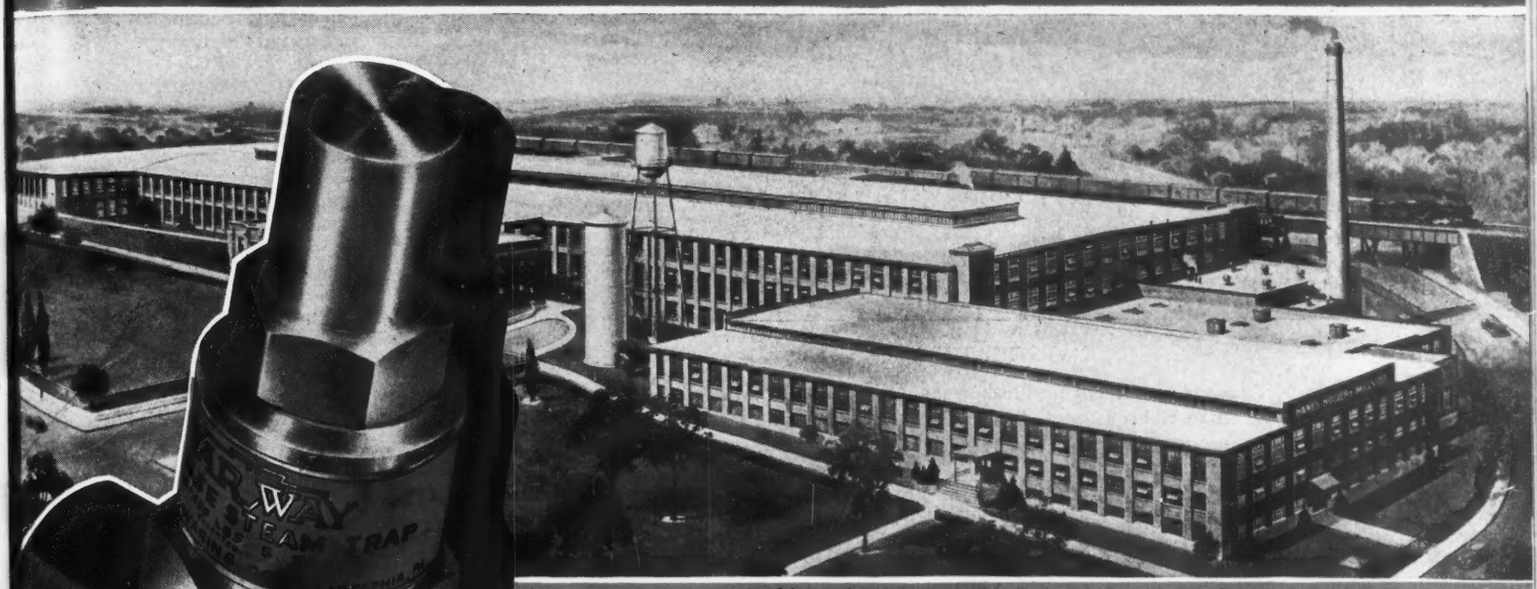
Mr Daubenmire, who is chief examining engineer for stationary engineers in Ohio, reported that of 100 men who seek licenses to be engineers, only 30 or 40 reveal themselves as qualified. About 90% already have prospective employment, he declared. Incompetent engineers endanger public safety, he said, and more standardization of qualifications and selection of better trained engineers is imperative.

Thomas C Thompson, local president and chief engineer of the municipal sewage-disposal plant, was chairman. Terms of office of the past presidents in attendance at the meeting spanned the years from 1890 to the present. Among guests of honor were Henry Lamy, president of Keystone Lodge in 1890, who assisted in drawing up the present city ordinance governing qualifications of stationary engineers, and Robert Ballacott of Lockport, one of the oldest members of the lodge.

Edison Medal to Torchio

Philip Torchio, who retired in 1938, at the age of 70, from the position of vice-president of the Consolidated Edison Co of New York, Inc, has been awarded the 1939 Edison Medal of the American In-

Yarway IMPULSE TRAPS
In Largest Circular Knit Hosiery Mill*



*Producing ladies' circular knit hosiery.

Hanes Uses YARWAY TRAPS Exclusively on Hosiery Dryers

To get the greatest efficiency from their 34 latest type Proctor and Schwartz stocking dryers—the Hanes Hosiery Mills at Winston-Salem, N.C., installed 34 Yarway Impulse Steam Traps and Strainers.

A ¾ in. Yarway Impulse Trap and Strainer (see view at left) drains each dryer individually—keeps it clear of condensate and air permitting close temperature control.

Yarway Traps are a big help to operators of all kinds of steam equipment. They save valuable space, simplify installation and maintenance. And since their purchase price is usually less than the cost of repairing an old-type trap—why not get Yarway performance for your money?

See your supply house or write for Catalog T-1734.

YARNALL-WARING COMPANY
100 Mermaid Avenue Philadelphia

YARWAY IMPULSE STEAM TRAP

INVESTIGATORS

Engineers inspect new air-blast circuit breakers at Allis-Chalmers switchgear lab in Milwaukee, Wis. Left to right: George A Matthews, Detroit Edison Co; Joe A Elzi, Commonwealth & Southern, Jackson, Mich.; C D Brown, Wis. Electric Power Co

stitute of Electrical Engineers, the highest award in electrical engineering.

The award was made to Mr Torchio "for distinguished contributions to the art of central-station engineering and for achievement in the production, distribution, and utilization of electrical energy."

The presentation will be made on the evening of Wednesday, January 24, during the winter convention of the Institute, which will be held in the Engineering Societies Building, New York, N. Y.

Penstock Valve Breaks at B.C. Hydro Plant

Damages estimated at a minimum of $5000 were recently caused at the power plant of the British Columbia Electric Railway Co at Japan Gulch, near Victoria, B.C., when the valve at the base of the penstock broke and the wall of the plant was blown out by the force of water, and equipment of the plant flooded.

Minimum cost of the damage was estimated at $5000, with every possibility that four times this amount would be recorded after closer investigation of the condition of the submerged machinery, according to G M Tripp, general superintendent of the company.

Midwest Power Conference in Chicago, April 9-10

Armour Institute of Technology, in cooperation with seven middlewestern universities and colleges and several local and national technical societies, is again sponsoring the annual Midwest Power Conference to be held in Chicago, April 9th and 10th, in the Palmer House Hotel. The conference is under the direction of Stanton E Winston, 401 S Quincy St, Hinsdale, Ill., Associate Professor of Mechanical Engineering at the Institute. Charles A Nash, 4715 N Spaulding Ave, Associate Professor of Electrical Engineering at the Institute, is secretary of the 1940 Conference.

The several mid-western colleges cooperating with Armour Institute in the sponsoring of the Midwest Power Conference, and their representatives are: Dr L E Grinter, vice-president, Armour Institute; Prof M P Cleghorn, head of the Department of Mechanical Engineering, Iowa State College; Prof F L Foltz, head of the Department of Electrical Engineering, Michigan State College; Prof C Francis Harding, head of the School of Electrical Engineering, Purdue University; and Prof H O Croft, head of the Department of Mechanical Engineering, State University of Iowa.

The purpose of the Power Conference has been established as that of offering an opportunity for all persons interested in power production, transmission or consumption to meet together annually for the study of mutual problems free from the restrictions of required memberships in technical or social organizations. The tentative program for the conference includes some 25 important subjects to be discussed by authorities from educational and industrial fields in all parts of the country.

FRIENDLY TIP

Readers and advertisers in POWER may occasionally receive mail solicitations offering a technical report on new developments in some branch of the power field, for a price ranging from $5.00 to $15.00, *cash in advance.*

We suggest caution in accepting such offers. In some cases we have investigated, the so-called 'report' or 'survey' has proved to be merely a compilation of reprints of articles previously published in various technical and business magazines.

For Pipe Designers

A collection of 100 pages of formulas and charts for calculation of forces, moments and stresses in steam piping will be published late in January by the Power Piping Division of Blaw-Knox Co, Pittsburgh. Authored by E A Wert and G Smith of the Detroit Edison Co, "Flex-Anal Charts" collects in one place simplified formulas that reduce amount of arithmetical computation to a minimum. Charts aid calculation of amount of movement, preferable locations for valves, welded and flanged joints for standard configurations; also text indicates applicability of these charts to structures for which no graphs have been prepared. May be had by engineers and designers by written request on business letterhead.

OBITUARIES

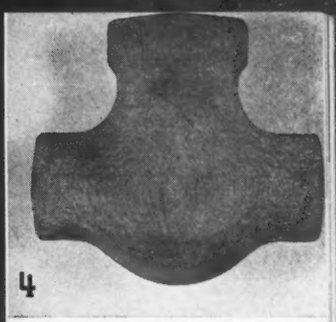
WILLIAM J HANLEY, 72, commercial vice-president of the General Electric Co with headquarters at Cleveland, Ohio, died on November 9, 1939. He was one of the veteran commercial men of the company, having completed 51 years of service, and was honored last year with a diamond-studded pin in recognition of his 50 years of service. Mr. Hanley began his career in 1888 with the old Thomson-Houston Co in Ohio as construction foreman, and the following year entered the railway dept. When the General Electric Co was formed by the merger of Thomson-Houston and Edison Electric, Mr Hanley continued with the new company. In 1903 he became a member of the supply department of the Cincinnati office; in 1905 being apppointed manager of the Columbus office, and in 1915 was elected commercial vice-president.

ROBERT WALKER, superintendent of the Tipp City, Ohio, municipal electric plant, died suddenly November 7, 1939, after undergoing an operation. He had been in charge of the plant for two years and supervised the $75,000 improvement program which was recently completed. He was formerly assistant engineer for the Hobart Manufacturing Co, Troy, Ohio.

RICHARD N FINDLAY, 71, plant operator for the Buffalo Niagara Electric Corp, in the Wilkeson St plant, died at his home in Buffalo.

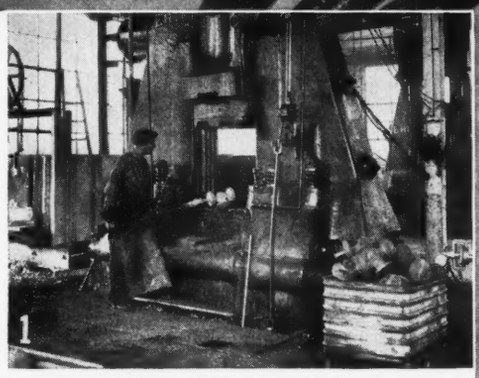
RALPH S MACPHERRAN, 68, chief chemist of the Allis-Chalmers Mfg Co, and only recently retired from service because of heart trouble, died November 13, at Duluth Minn. He was born at Sterling, Ill., in 1871, received his technical education at the University of Wisconsin and University of Michigan, and was graduated from the latter institution in 1892 with a degree of Bachelor of Science in Chemistry. He joined the Allis-Chalmers organization in 1895.

FORGINGS BREED CONFIDENCE



Sinking a drop forging die is nice work. One test is resultant fibre flow, revealed upon halving the forging.

Modern measuring tools give speed and accuracy when used to check Edward bodies after machining from forgings.



Pounding choice rolled steel stock under a heavy drop hammer increases its density until voids just can't exist. That's why users naturally have faith in valve body forgings.

Forging at high heat develops growth of grain structure — which may be corrected by proper heat-treatment. Edward normalizing furnaces are fired with refinery gas.

From cooling floor, forgings pass to revolving table where steel particles slung at high velocity remove oxidized jacket from heat-treated forging, preparing it for machining.

FORGINGS breed confidence. So Edward uses them wherever they are better than castings* or rolled steel. But you can't take forgings for granted until the raw material has survived acceptance tests. And before that, it takes years of study of the problems peculiar to high pressure valves before "specs" can be written wisely. Even when the stock is released for manufacture, after running the Edward testing gauntlet, inspectors hover near to throw out suspicious parts.

* Edward prefers castings for bodies over 2 inch.

THE EDWARD VALVE & MANUFACTURING CO., INC.
EAST CHICAGO INDIANA

EDWARD VALVES

Stop · Check · Blow-off · Non-return · Feed Line · Relief · Bleeder Line · etc.

CLEMENT RUEGG, 59, chief diesel engineer and designer of the Nordberg Mfg Co, died at his home in Milwaukee, Wis., November 10, 1939. He designed the company's first diesel engine in 1917. Mr Ruegg was born in Fischenthal, Switzerland, served his apprenticeship in the Swiss Locomotive & Machine Works, and later worked in France for 5 years. In 1906 he started work in a diesel plant in Brussels, and after coming to the United States, joined the Nordberg Company in 1916.

HENRY MULFORD, 64, pioneer in the electrical field, and one of the few who received the diamond pin awarded by the Associated Gas and Electric System for 50 years of service, died at his home in Patchogue, L. I. on November 22, 1939. Mr Mulford began work, with a part time job, in 1887, when, at the age of thirteen, he was engaged as dynamo tender and lamp trimmer. At the close of his schooling, before he was to enter high school, he took the job as a full-time proposition. After serving with the company for several years he advanced and attained the position of chief electrician, which he held at the time of his death.

JOSEPH E MONTAGUE, 64, who had retired from active service recently, died after a 2-day illness at Niagara Falls, N. Y., November 25. He had retired since the merger of the William R Huntley Co of Buffalo, and the Niagara Falls Electric Co. Formerly a power salesman, Mr Montague came to Niagara Falls in 1903, becoming general manager of the Buffalo and Niagara Falls Electric Light & Power Co, and later head of the service company until the merger.

FLOYD REBBERY, 40, manager of the municipal power plant at Hartville, Mo., died December 11 of injuries suffered from a self-inflicted wound. It was reported that Mr Rebbery had been despondent after the diesel engines in his charge had failed.

FRITZ J FRANK, 68, president of the Iron Age Publishing Co, died on December 8, after a short illness. He began life in Emporium, Pa., received his technical education at Rollins College, Florida, and immediately after his graduation entered the publishing field. In 1911 he was made secretary of the David Williams Publishing Co, the predecessor of the Iron Age Publishing Co, and in 1918 was elected vice-president. In 1919 he became president and held that position up until the time of his death.

FRANK LUDLAM, assistant secretary and assistant treasurer of the International Nickel Co, Inc, died on December 8 at his home in New York, after a long illness. He was born in Bloomfield, N. J., and attended the Lyons School in New York, and the Columbia School of Mines, where he studied architecture. After spending several years in that field, he took a position in the Carnegie Steel Co, at Pittsburgh, later joining the International Nickel Co.

JOHN F G MILLER, 63, vice-president, B F Sturtevant Co, Boston, Mass., died at Brookline, Mass., December 9.

Meetings

American Institute of Electrical Engineers —*Winter Convention, January 22–26, Engineering Societies Bldg, New York, N. Y. H H Henline, Secretary, 29 W 39th St.*

American Society of Heating & Ventilating Engineers—*Annual meeting in conjunction with 6th International Heating & Ventilating Exposition, January 22–26, Lakeside Hall, Cleveland, Ohio. A V Hutchinson, secretary, 51 Madison Ave, New York, N. Y.*

American Society of Mechanical Engineers —*Spring meeting, May 1–3, 1940, Worcester, Mass. C E Davies, secretary, 29 39th St, New York, N. Y.*

American Society of Refrigerating Engineers—*35th Annual Meeting, January 16–18. Blackstone Hotel, Chicago, Ill. David L Fiske, secretary, 37 W 39th St, New York, N. Y.*

Louisiana Engineering Society — *45th Annual Meeting, January 12–13, St. Charles Hotel, New Orleans, La. A M Hill, secretary-treasurer, 423 St. Charles Hotel, New Orleans, La.*

Refrigerating Service Engineers Society— *Annual Convention, January 15–18, Chicago, Ill. H T McDermott, secretary, 433 N Waller Ave, Chicago, Ill.*

BUSINESS ITEMS

CRANE CO, Chicago, Ill., announces appointment of new director of publicity, H L Delander, for many years editor of *The Valve World*, Crane house-organ.

MECHANICAL HANDLING SYSTEMS, INC, Detroit, Mich., has appointed new engineering-sales concerns to represent the company in the east. Wonham, Inc, 44 Whitehall St, New York, N. Y. will represent the company in Connecticut, northern New Jersey, and southern New York, while Kearny Engrg Co, 2402 Market St, Philadelphia, Pa., has been assigned southern New Jersey, Wilmington, Del. and eastern Pennsylvania.

HEWITT RUBBER CORP, Buffalo, N. Y., announces appointment of following distributors: Wimberly & Thomas Hardware Co, Birmingham, Ala.; Machinery & Supplies Co, Kansas City, Mo.; Bitco, Inc, Wallace, Idaho; McChesney-Rand Equipment Co, Albuquerque, N. M.; P J Hanns Co, Eugene, Ore.; Texas Belting & Supply Co, Houston, Texas, and C D Franke & Co, Charleston, S. C.

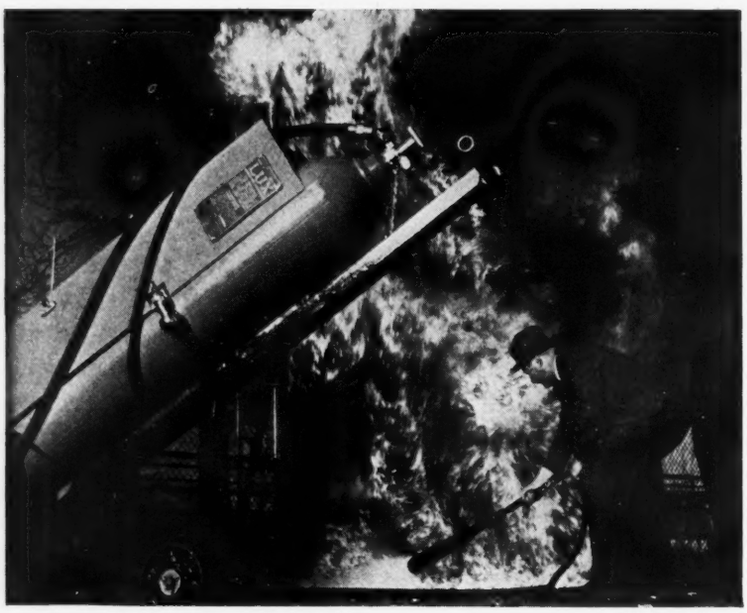
INTERNATIONAL NICKEL CO announces personnel change in organization at Bayonne, N. J. laboratory. Executive group now includes Dr N B Pilling, director; Dr W A Wesley, assistant director; E M Wise, staff advisor and D C West, manager.

J B Spotswood, branch operating manager, UNITED STATES RUBBER CO, Chicago, Ill., has retired from active service. Succeeding Mr Spotswood will be W J Laliberte, branch operating manager of Kansas City. C A Gray, branch operating manager at Buffalo, N. Y., who has been transferred to Kansas City, will be succeeded at Buffalo by H A Dathe, formerly at the New York office.

COPPUS ENGRG CORP, Worcester, Mass., announces appointment of following new district representatives. Rees V Downs, 422 Exchange Bldg, Memphis, Tenn.; Hughes Machinery Co, 342 Manufacturers Exchange Bldg, Kansas City, Mo.; and L D McKay, 833 Mayo Bldg, Tulsa, Okla.

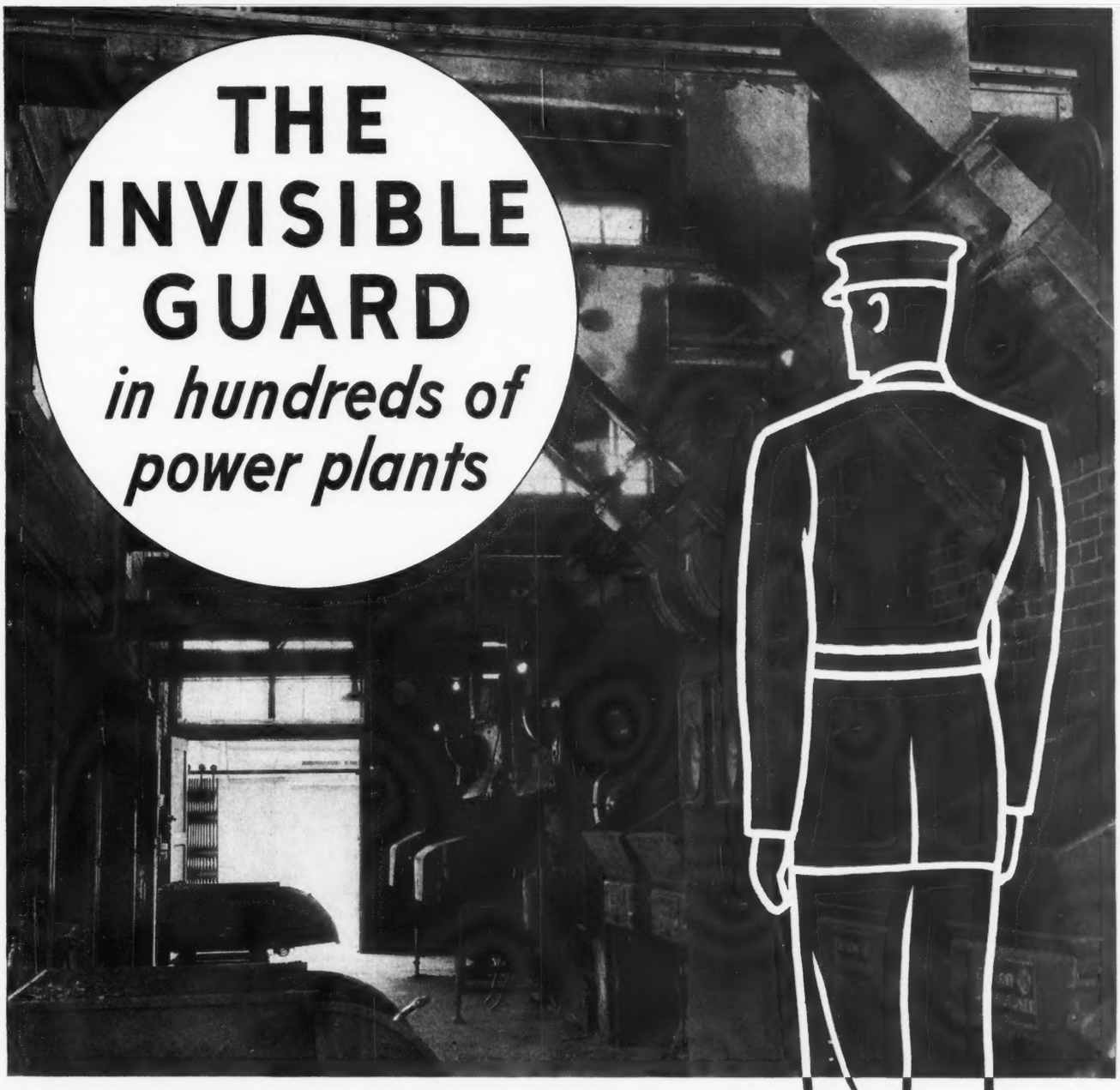
CENTRIFIX CORP, 3028 Prospect Ave, Cleveland, Ohio, has appointed Sawyer-Massey, Ltd, of Hamilton, Ont., as its exclusive Canadian manufacturers.

ERNEST D KEY, president of the Atlanta Belting Co, Atlanta, Ga., was elected presi-



SNOWING-UNDER AN OIL FIRE

A demonstration of the early stages of blanketing a running-liquid oil fire with CO_2, being shown all over the country by a portable unit of Walter Kidde & Co. Always work at the base of the fire, say the experts



IF YOU are anxious to keep your boilers on the line as continuously as possible, you will be vitally interested in the impressive record that is being achieved by Nalco in rendering service to more than 3500 leading industrial plants. We should be pleased to give you the facts and names of prominent Nalco System users near you.

Adoption of the Nalco System requires no additional capital investment. Total cost may be less than your present expenditures for chemicals alone. Write for complete information. NATIONAL ALUMINATE CORPORATION, 6222 W. 66th Place, Chicago, Ill.

THE Nalco SYSTEM OF FEEDWATER TREATMENT

Inquiries other than domestic, *except those from U. S. Possessions, Canada and Mexico,* should be addressed to ALFLOC LTD., Bush House, Aldwych, London, W. C. 2, Eng. Canadian inquiries should be sent to ALUMINATE CHEMICALS LTD., 372 Bay St., Toronto, Ont.

dent of the American Leather Belting Assn, at the annual meeting held in New York on December 12, 1939. Other officers are: Geo L Abbott, Graton & Knight Co, 1st vice-president; Preston DeG Baldwin, Baldwin Belting & Leather Co, 2nd vice-president; and J L Nelson, secretary.

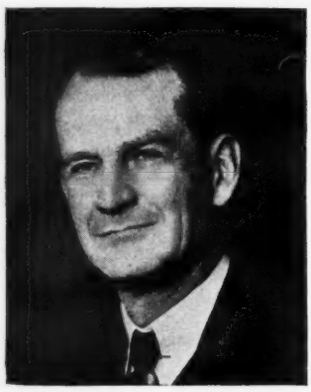
WHEELCO INSTRUMENTS Co, Chicago, Ill., has appointed Rodgers Engrg Co, 204 Thomas Bldg, Dallas, Texas, as its representative in north Texas.

PERSONALS

E A BENDING has joined Wm Bros Boiler & Mfg Co, Nicollet Island, Minnesota. He was formerly associated with the Middle West Utilities Co of Chicago, and later with the Hoffman Combustion Engrg Co of Detroit. He will engage in sales promotion and engineering assistance in the Watertube Boiler and Spreader Stoker Division.

CLAYTON P INNES is the new Cutler-Hammer representative in the company's Omaha territory. Mr. Innes is a graduate of South Dakota State College with a degree in Electrical Engineering and has had previous experience in the field.

MAYNARD D CHURCH has been elected vice-president of Worthington Pump & Machinery Corp, Harrison, N. J. Mr Church is also president of Moore Steam Turbine Corp, Wellsille, N. Y., which is a Worthington subsidiary. He will continue in charge of Moore operations. Mr Church joined the Kerr Turbine Co in 1906, after his graduation from Syracuse



M D Church

University. He left that position to become vice-president and chief engineer of the Dayton Turbine Pump Co. From 1915 to 1924 he served as chief engineer of Terry Steam Turbine Co, and in 1921 became general manager of Moore Steam Turbine Co. He was elected president later that year.

A W PRIDE has been appointed manager of the Porcelain Dept of Westinghouse Electric & Mfg Co. In addition to his duties as manager of that department, he will retain his position as sales manager of the Transformer Dept, both of which are in Emeryville, Calif. He has been with Westinghouse since 1915 when he enrolled

(*Continued on page* 138)

NEW PLANT CONSTRUCTION

McGraw-Hill Business News Department Is Prepared to Furnish a More Complete Daily Service

Ala., Mobile—Alabama Power Co., 600 N. 18 St., Birmingham, will construct new steam plant, industrial area, by own forces. $4,000,000.

Calif., Glendale—City, Pub. Serv. Dpt., City Hall, plans constructing rein.-con., steel power plant, San Fernando Rd. $150,000.

Calif., Oakland—Loose-Wiles Biscuit Co., 832 Sansome St., San Francisco, plans constructing 150x1200 ft., biscuit and cracker plant, 81 Ave., San Leandro St. Over $250,000. Site purchased.

Del., Edge Moor—E. I. duPont de Nemours & Co., Inc., duPont Bldg., Wilmington, will construct plant addition. Over $1,000,000. Owner builds. Private plans.

Florida—United States Sugar Corp., C. R. Bitting, pres., 20 Exch. Pl., New York City, plans constructing sugar house to grind 6,000 tons sugar cane per day. Over $500,000. Site not selected, will be located in Florida Everglades. Private plans.

Ga., Brunswick—Brunswick Pulp & Paper Co., jointly owned by Scott Paper Co. of Chester, Pa., and Meade Corp., of Chillicothe, O., plans constructing additions, improvements to plant, digester addition, spiral heat exchanger, 75 ton recovery unit, back pressure turbine, certain screen room changes, new and larger washer, etc., to increase rate production from 150 to nearly 200 tons per day. About $500,000. E. Gayner, vice pres. and genl. mgr.

Illinois, Iowa and Missouri—Union Electric Co. of Missouri, W. McCellan, pres., 12 and Locust Sts., St. Louis, Mo., plans constructing new power plant at Venice, Ill., two 300,000 lb. per hr. boilers to be installed in Ashley St. plant, St. Louis, Mo., smoke elimination equipment for Ashley St. plant, St. Louis, Mo., and Cahokia plant, Cahokia, Ill., changes to be made in equipment, Madison Co., Ia., to provide 60 cycle lighting instead of present 25 cycle, other imprvs. and betterments to sys. $20,000,000. Private plans.

Ill., Moline—Peoples Power Co., 1400 Fifth Ave., plans constructing automatic transformer station 17 St. and 3rd Ave. $75,000.

Ill., Rock Island—Peoples Power Co., 1800 3 Ave., plans constructing automatic transformer station, 6 Ave. and 14 St. $75,000.

Ind., Indianapolis—Central State Hospital, Dr. M. Bahr, supt., W. Washington St., plans by O. A. Tislow, 819 Architects & Builders Bldg., constructing 1 story, 50x60 ft., brick, rein.-con., steel power house, waterproofing 2 tubular boilers, stokers, vacuum pump, circulating pumps. $40,000.

Ind., Richmond—City, receives bids early in 1940, for new boilers for light plant. $100,000 appropriated by City Council.

Ia., Dubuque—A. Y. McDonald Mfg. Co., Dubuque, plans constructing 2 story 52x268 ft. manufacturing plant. $75,000. Cullen & Bartels, 210 Lincoln Bldg., engrs.

Ia., Dunscome—City plans new diesel engine and auxiliaries for light plant. $25,000.

Ia., Gowrie—Bids Jan. 17, by City, extending light plant, one diesel engine, 300 to 375 hp. with generator and exciter and auxiliary equip. Stanley Eng. Co., Muscatine, engrs.

Ia., Muscatine—Bids Jan. 15, by City, for Sects. 10, 11, 12 coal handling equipment, feedwater heaters, power plant piping at power plant. Total est. $606,482. Stanley Eng. Co., Muscatine, engrs.

Ia., Waukon—City, making surveys and plans constructing electric light and power plant. Hubbard Eng. Co., 80 E. Jackson St., Chicago, Ill., engrs.

Kan., Kansas City—City making plans constructing packing building and garage in Public Levee Dist. $350,000. Alonzo H. Gentry, Voskamp & Neville, 4 W. 13 St., Kansas City, Mo., archts.

La., Baton Rouge—Ethyl Gasoline Corp., Jackson Rd., soon lets contract constructing large anti-knock or ethyl gasoline manufacturing plant. $3,500,000. Engineer c/o owner.

La., Lake Charles—Mathieson Alkali Works, Lake Charles and 60 E. 42 St., New York, E. M. Allen, pres., I. V. Maurer, genl. mgr., New York, plans expanding present plant. $1,600,000. Private plans.

Md., Baltimore—Western Maryland Dairy, Linden Ave. and Dolphin St., receives bids about Mar. 1, constructing 1 story, brick, rein.-con. dairy plant. $1,000,000 or more. Stone & Webster Eng. Corp., 49 Federal St., Boston, Mass., engrs.

Minn., Rushford—City, C. Reishus, city clk., plans constructing power house and diesel generating plant. $75,000. E. A. Briggs, 1955 University Ave., St. Paul, engrs.

Minn., St. Cloud—Northern States Power Co., 15 S. 5 St., Minneapolis, W. Whitney, mgr. St. Cloud Div., plans constructing 7,500 kw. steam driven generator and boiler to be housed in new 60 x 120 ft. brick building. $600,000. Maturity spring.

Miss., Columbus—Extending municipal electric light and power distribution system. $45,000. Beard Eng. Co., 2606 Oakview Terrace, St. Louis, Mo., engr.

N. H., Concord—New Hampshire Electric Cooperative, Inc., Phoenix Bldg., 46 W. Main St., plans constructing 327 mi. electric transmission lines, generating plant, with power equipment. $385,000. J. W. Worcester & Co., 79 Milk St., Boston, Mass., engrs.

N. J., Elizabeth—Peter J. Schweitzer, Inc., 994 Newark Ave., plans constructing 1 story, brick, steel concrete factory, Newark Ave. $1,000,000. Architect not appointed.

N. Y., Amsterdam—New York Power & Light Corp., Amsterdam, plans constructing 3,000 kw. power station, W. Main St. and Guy Park Ave. $50,000. Owner's engineer, C. W. Martin in chrage.

N. Y., New York—National Gypsum Co., 190 Delaware Ave., Buffalo, plans constructing plant extension, Oak Pt. Ave. and Cabot St. $2,000,000. Private plans.

N. Y., Plattsburg—Bids Jan. 17, by City, furnishing diesel engine generators, Contr. 1, for new power plant. $175,000. Total est. $520,000. Burns & McDonnell, 107 W. Linwood Blvd., Kansas City, Mo., engrs.

North Dakota—Nodak Rural Electric Cooperative, Grand Forks, plans constructing power plant for rural electrification project. Considering various points. $100,000. Maturity early spring.

O., Cleveland—Cleveland Electric Illuminating Co., 75 Public Square, bids asked after January 1, general contract, constructing power plant. Total est. $6,000,000. 5,000 tons structural steel, awarded to American Bridge Co., Rockefeller Bldg.

O., Kenton—Rinkle Candy Co., W. T. Johnson, pres., plans rebuilding plant destroyed by fire. $100,000.

O., Mt. Gilead—Hydraulic Press Mfg. Co., Mt. Gilead, stockholders voted $500,000 to be used for constructing new factory and purchasing equipment.

O., Oxford—Bids Jan. 15, by C. G. Wahl, dir. P. Wks., State Office Bldg., Columbus, constructing power plant improvements at Miami University, new boiler feed and vacuum pumps and piping, radial brick chimney and foundations, smoke breeching and insulation. $30,000. J. P. Schooley, Columbus, state archt. Fosdick & Hilmer, Union Trust Bldg., Cincinnati, engrs.

Okla., Stillwater—City voted $60,350 bonds, for new 5,000 hp. high pressure boiler for power plant; $170,000 bonds for 4,000 kw. steam turbine and generator set; $59,650 bonds for feed water auxiliaries and steam piping for steam power plant; $66,525 bonds remodeling electric distribution sys. G. H. Randleman, Stillwater, engr.

Pa., Ephrata—Boro Council, W. Carter, chn. Comn., in charge, plans altering, improving and constructing additions to municipal light and power plant. Over $40,000. L. T. Klauder, Lincoln-Liberty Bldg., Phila., engr.

Pa., Pittsburgh—Duquesne Light Co., F. R. Phillips, pres., 435 6 Ave., will construct 80,000 hp. generating unit at James H. Reed Power Station, Brunot Island, by own forces. Furnishing 80,000 hp. turbine generator unit, to Westinghouse Electric & Mfg. Co., Union Bank Bldg. Est. $5,000,000. Total program $16,000,000.

Tenn., Dayton—Dayton Veneer & Lumber Co., plans rebuilding 4 warehouses, boiler and light plants, etc. $200,000. Owner probably builds same.

Tenn., Memphis—Swift & Co., 35 Union St., plans constructing ice cream plant. $75,000. Private plans.

Tenn., Nashville—Aviation Mfg. Corp., 420 Lexington Ave., New York City, plans by Albert Kahn, Inc., 345 New Center Bldg., Detroit, Mich., constructing 1 story airplane factory and 2 story office. $400,000.

Tex., Cayuga—Lone Star Gasoline Co., plans constructing recycling plant. $200,000.

Tex., Coleman—City, E. P. Scarbrough, mayor, voted bonds constructing electric light and power plant improvements. $85,000. Terrell Bartlett Engineers, Gunter Bldg., San Antonio, engrs.

Tex., Texarkana—W. V. Brown, mayor, defeated bonds, constructing power plant. $545,000. J. E. Ward, Harvey Snider Bldg., Wichita Falls, engr.

Tex., Texas City—American Refining Corp., Texas City, and 31 Union Square, New York, N. Y., plans constructing refinery unit, laboratory branch, also extension in power house equip. for present plant. $250,000.

Wis., Fennimore—Town plans constructing Municipal electric light plant. $70,000. G. H. Lieser, Portage, engr.

Wis., Kaukauna—Kaukauna Utilities Comn., taking bids 15 ton electric gate hoist on trolley for lifting penstock gates, electric crane, outdoor substation and electric switchboard and controls for hydro-electric plant. Mead, Ward & Hunt, Madison, engrs.

Wis., Sheboygan—Wisconsin Power & Light Co., 122 W. Washington Ave., Madison, plans constructing generating plant addition, $2,000,000. Sargent & Lundy, Inc., 140 S. Dearborn St., Chicago, Ill., engrs.

B. C., Prince George—City plans constructing power plant. Over $25,000. J. C. MacKenzie, City Hall, engr.

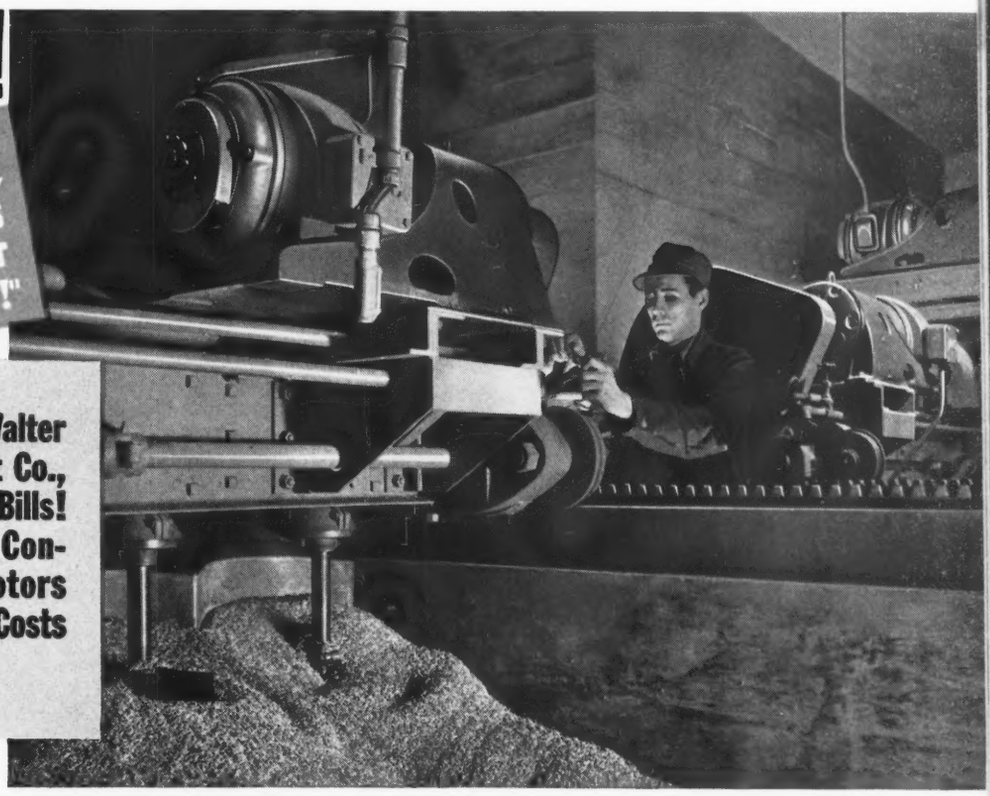
7 HARD YEARS ON THE JOB WITH...

NO TIME-OUTS

FOR REPAIRS!

Another true case history from the Allis-Chalmers files that proves **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

Here's a Tip from President Walter A. Zinn, Milwaukee Western Malt Co., on How to Cut Motor Repair Bills! Find Out What Full Measure Construction in Lo-Maintenance Motors Can Mean to You . . . in Lower Costs . . . in Less Man Hours Lost!



OPERATING 24 HOURS A DAY AT The Milwaukee Western Malt Company plant . . . in air that's hot and humid . . . this Allis-Chalmers Lo-Maintenance Motor is typical of the 86 that were seven hard years on the job with no time outs for repairs!

If you were building a new addition to your plant . . . if you wanted to double your capacity . . . get a better product at lower cost . . . you'd want to be sure every piece of equipment you bought held up its end of the job . . . without stopping production . . . without running up excessive maintenance costs!

That's what Walter A. Zinn was looking for when he expanded his plant in 1932. And because Mr. Zinn, besides being president of the Milwaukee Western Malt Co., is also an engineer and had designed many of the new plant's production features . . . he was mighty particular about the motors he was choosing.

"When you turn out 2,600,000 bushels of malt a year," said Mr. Zinn, "you've got to keep production rolling. You can't afford time-outs for motor repairs. That's why I turned the motor job over to Allis-Chalmers.

No Repair Bills!

"And I wasn't wrong by a long shot! In the seven years they have been running in my plant, the only thing those Allis-Chalmers Motors haven't given us is costly repair bills!"

That's what Mr. Zinn and hundreds of other executives say about Lo-Maintenance Motors. And that's what you'll say about Lo-Maintenance Motors once you put them to work for you!

There's more than just a rated horsepower in the Full Measure Construction of Lo-Maintenance Motors. High carbon steel frame . . . indestructible rotor and distortionless stator . . . plus Allis-Chalmers 90 years of working hand-in-hand with industry . . . these are extra value features that give you extra years of trouble-free service!

Get in touch with the trained production engineer in the nearest Allis-Chalmers district office! Let him show you how you can cut costs . . . keep production steady with Allis-Chalmers Lo-Maintenance Motors!

1096

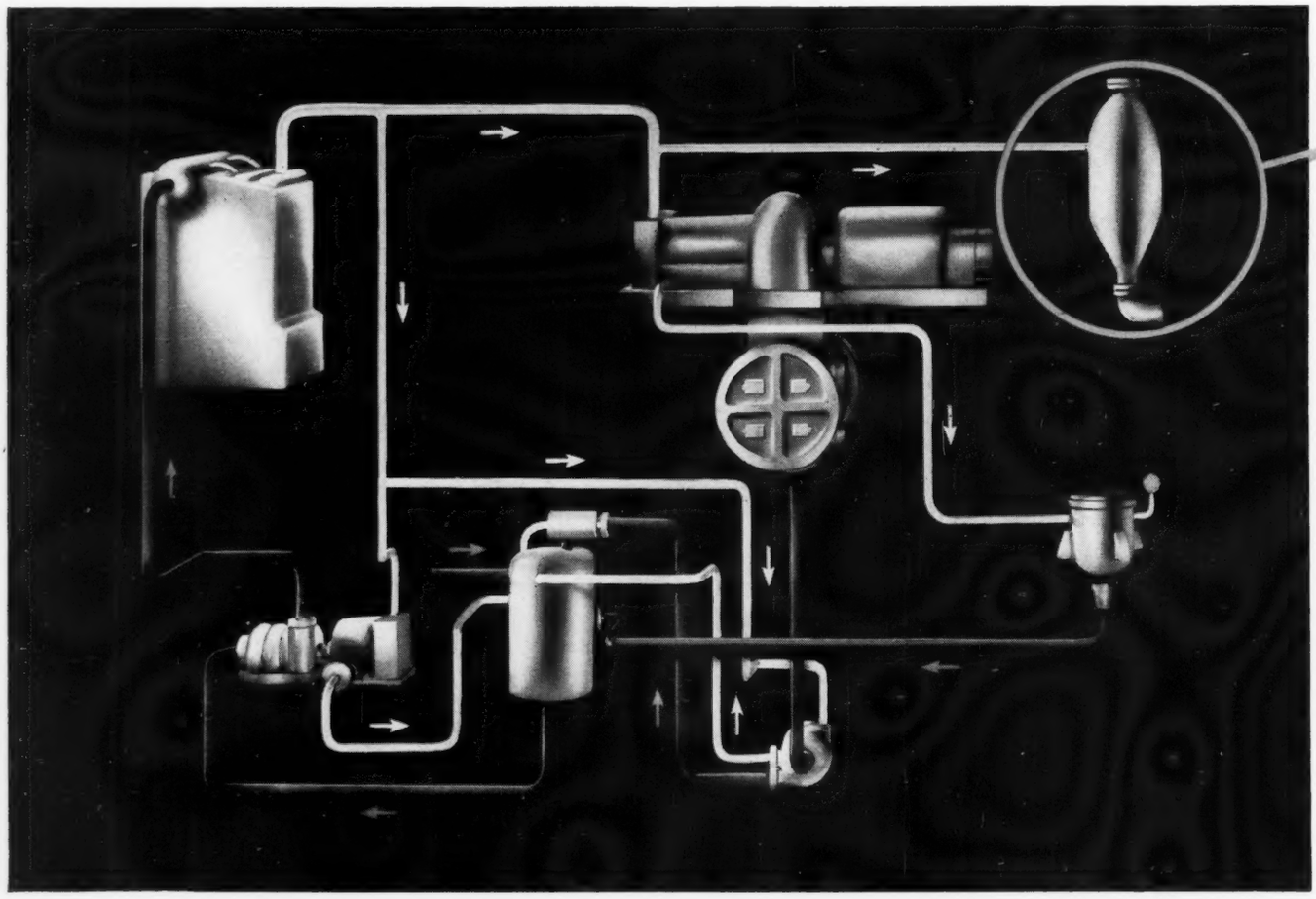
Over 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

FROM *GOOD* POWER HOOKUPS

FOR H.P. PROCESS STEAM...



Courtesy—Powar Magazine

HOOKUP #14 **Economy of process-power plant depends largely on combining prime movers and auxiliaries to match load. Where process and power load are not too greatly unbalanced, a condensing turbine makes power efficiently, and steam that has already been used in turbine can be extracted for 1-p process. Auxiliary exhaust heats feed but extracted steam could be used, with motor drives.**

TO PLANTS that require steam at more than one pressure, the Paper Mill Digester diagram on the opposite page illustrates the function and valve connections of *any* High Pressure Process Equipment.

Other h-p units may be operated from the same header and condensate may be trapped back to the feed system —thus conserving make-up requirements and heat units otherwise wasted. Valves are located in accordance with "Good Valve Practice" and are keyed to the Jenkins Figure Number list at the right. Under each service classification you will find a choice of several recommended valves.

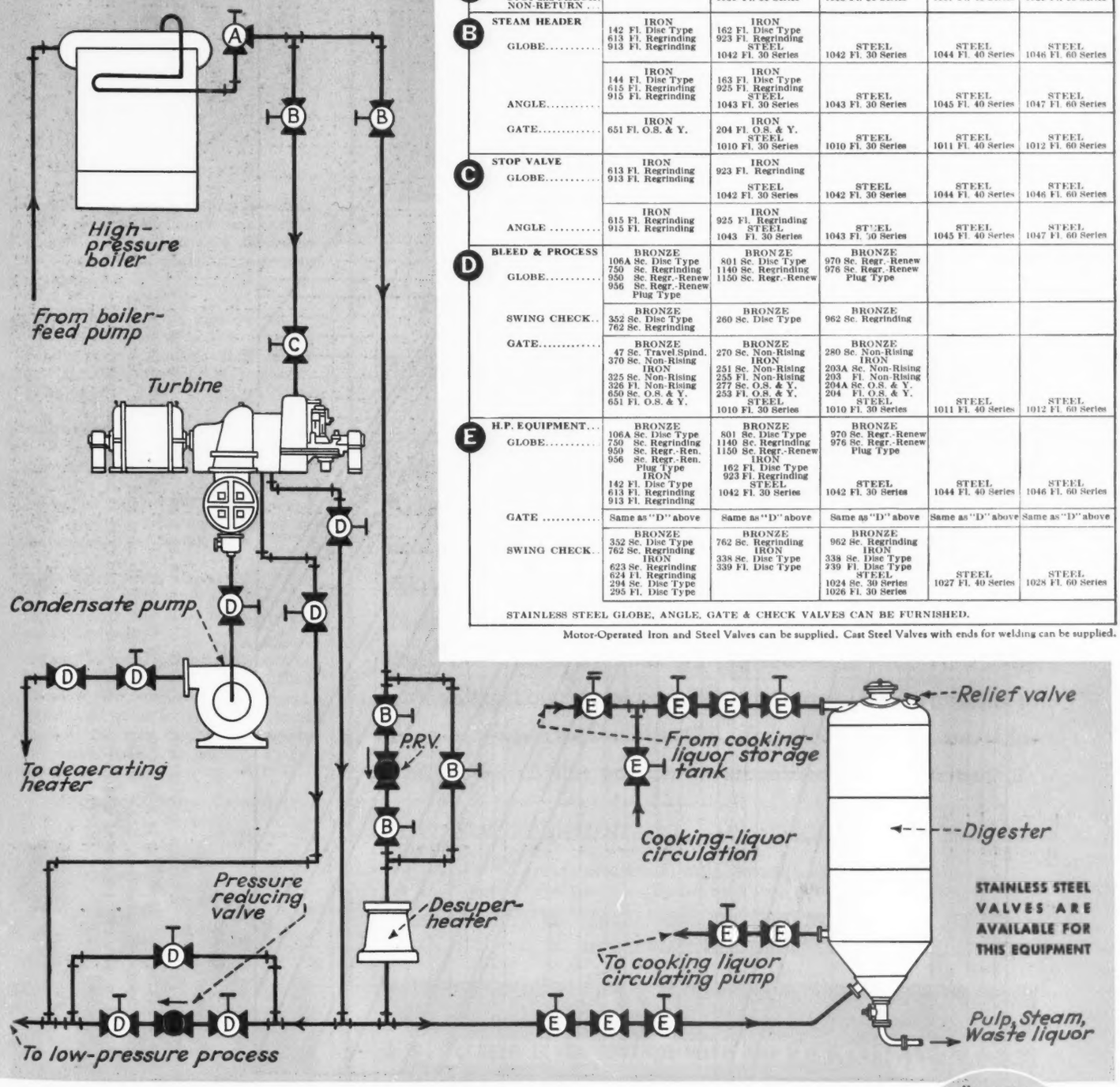
NEXT MONTH—L.P. PROCESS STEAM

IN VALVES *Jenkins* GIVES YOU EVERYTHING

. . . TO *GOOD* VALVE PRACTICE

Jenkins RECOMMENDS . . .

PAPER MILL APPLICATION



REFERENCE CHART TO JENKINS FIGURE NUMBERS FOR H. P. PROCESS EQUIPMENT

		100 lbs. S.P.	Up to 200 lbs. S.P.	Up to 300 lbs. S.P.	Up to 400 lbs. S.P.	Up to 600 lbs. S.P.
A	BOILER STOP AUTOMATIC EQUALIZING STOP and CHECK, NON-RETURN	IRON 293 Fl. I.B.B.M.	IRON 293 Fl. I.B.B.M. STEEL 1055 Fl. 30 Series	STEEL 1055 Fl. 30 Series	STEEL 1057 Fl. 40 Series	STEEL 1059 Fl. 60 Series
B	STEAM HEADER GLOBE	IRON 142 Fl. Disc Type 613 Fl. Regrinding 913 Fl. Regrinding	IRON 162 Fl. Disc Type 923 Fl. Regrinding STEEL 1042 Fl. 30 Series	STEEL 1042 Fl. 30 Series	STEEL 1044 Fl. 40 Series	STEEL 1046 Fl. 60 Series
	ANGLE	IRON 144 Fl. Disc Type 615 Fl. Regrinding 915 Fl. Regrinding	IRON 163 Fl. Disc Type 925 Fl. Regrinding STEEL 1043 Fl. 30 Series	STEEL 1043 Fl. 30 Series	STEEL 1045 Fl. 40 Series	STEEL 1047 Fl. 60 Series
	GATE	IRON 651 Fl. O.S. & Y.	IRON 204 Fl. O.S. & Y. STEEL 1010 Fl. 30 Series	STEEL 1010 Fl. 30 Series	STEEL 1011 Fl. 40 Series	STEEL 1012 Fl. 60 Series
C	STOP VALVE GLOBE	IRON 613 Fl. Regrinding 913 Fl. Regrinding	IRON 923 Fl. Regrinding STEEL 1042 Fl. 30 Series	STEEL 1042 Fl. 30 Series	STEEL 1044 Fl. 40 Series	STEEL 1046 Fl. 60 Series
	ANGLE	IRON 615 Fl. Regrinding 915 Fl. Regrinding	IRON 925 Fl. Regrinding STEEL 1043 Fl. 30 Series	STEEL 1043 Fl. 30 Series	STEEL 1045 Fl. 40 Series	STEEL 1047 Fl. 60 Series
D	BLEED & PROCESS GLOBE	BRONZE 106A Sc. Disc Type 750 Sc. Regrinding 950 Sc. Regr.-Renew 956 Sc. Regr.-Renew Plug Type	BRONZE 801 Sc. Disc Type 1140 Sc. Regrinding 1150 Sc. Regr.-Renew	BRONZE 970 Sc. Regr.-Renew 976 Sc. Regr.-Renew Plug Type		
	SWING CHECK	BRONZE 352 Sc. Disc Type 762 Sc. Regrinding	BRONZE 260 Sc. Disc Type	BRONZE 962 Sc. Regrinding		
	GATE	BRONZE 47 Sc. Travel Spind. 370 Sc. Non-Rising IRON 325 Sc. Non-Rising 326 Fl. Non-Rising 650 Sc. O.S. & Y. 651 Fl. O.S. & Y.	BRONZE 270 Sc. Non-Rising IRON 251 Sc. Non-Rising 255 Fl. Non-Rising 277 Sc. O.S. & Y. 253 Fl. O.S. & Y. STEEL 1010 Fl. 30 Series	BRONZE 280 Sc. Non-Rising IRON 203A Sc. Non-Rising 203 Fl. Non-Rising 204A Sc. O.S. & Y. 204 Fl. O.S. & Y. STEEL 1010 Fl. 30 Series	STEEL 1011 Fl. 40 Series	STEEL 1012 Fl. 60 Series
E	H.P. EQUIPMENT GLOBE	BRONZE 106A Sc. Disc Type 750 Sc. Regrinding 950 Sc. Regr.-Ren. 956 Sc. Regr.-Ren. Plug Type IRON 142 Fl. Disc Type 613 Fl. Regrinding 913 Fl. Regrinding	BRONZE 801 Sc. Disc Type 1140 Sc. Regrinding 1150 Sc. Regr.-Renew IRON 162 Fl. Disc Type 923 Fl. Regrinding STEEL 1042 Fl. 30 Series	BRONZE 970 Sc. Regr.-Renew 976 Sc. Regr.-Renew Plug Type STEEL 1042 Fl. 30 Series	STEEL 1044 Fl. 40 Series	STEEL 1046 Fl. 60 Series
	GATE	Same as "D" above	Same as "D" above	Same as "D" above	Same as "D" above	Same as "D" above
	SWING CHECK	BRONZE 352 Sc. Disc Type 762 Sc. Regrinding IRON 623 Sc. Regrinding 624 Fl. Regrinding 294 Sc. Disc Type 295 Fl. Disc Type	BRONZE 762 Sc. Regrinding IRON 338 Sc. Disc Type 339 Fl. Disc Type	BRONZE 962 Sc. Regrinding IRON 338 Sc. Disc Type 339 Fl. Disc Type STEEL 1024 Sc. 30 Series 1026 Fl. 30 Series	STEEL 1027 Fl. 40 Series	STEEL 1028 Fl. 60 Series

STAINLESS STEEL GLOBE, ANGLE, GATE & CHECK VALVES CAN BE FURNISHED.

Motor-Operated Iron and Steel Valves can be supplied. Cast Steel Valves with ends for welding can be supplied.

JENKINS BROS., 80 WHITE STREET, NEW YORK, N. Y.

Bridgeport • Boston • Chicago — Philadelphia • Atlanta • Houston

TRADE JENKINS MARK — Jenkins Bros

#14 OF A SERIES designed to help in your selection of JENKINS VALVES

Number 90

Pressure-Temperature Chart for Refrigerants

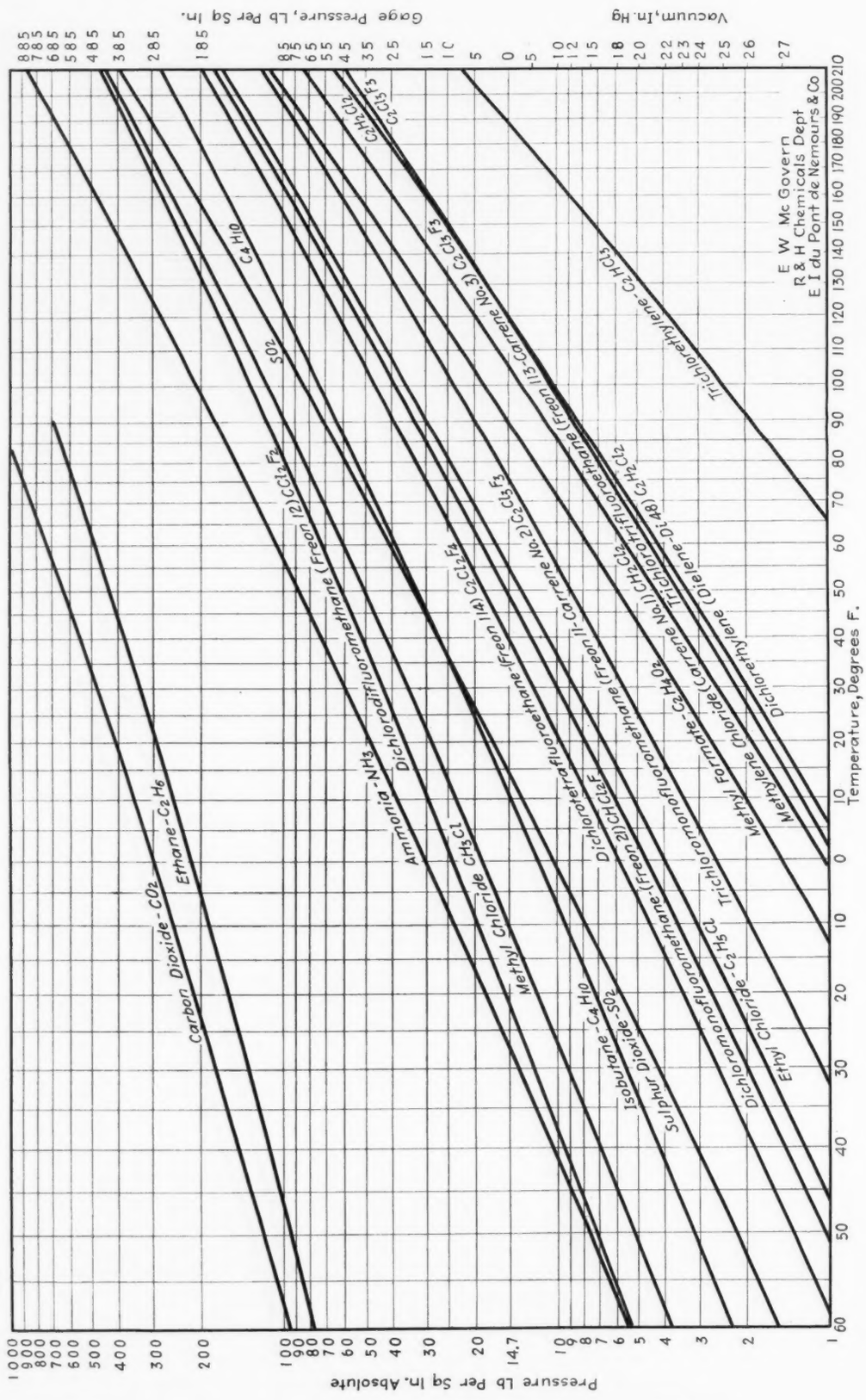
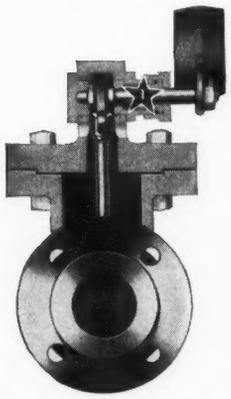

Pressure Lb Per Sq In. Absolute
Gage Pressure, Lb Per Sq In.
Vacuum, In. Hg
Temperature, Degrees F.
E W Mc Govern
R & H Chemicals Dept
E I du Pont de Nemours & Co
Carbon Dioxide - CO2
Ethane - C2 H6
Ammonia - NH3
Dichlorodifluoromethane (Freon 12) CCl2F2
Methyl Chloride CH3Cl
Isobutane - C4 H10
Sulphur Dioxide - SO2
Dichloromonofluoromethane (Freon 21) CHCl2F
Dichlorotetrafluoroethane (Freon 114) C2Cl2F4
Trichloromonofluoromethane (Freon 11 - Carrene No. 2) CCl3F
Ethyl Chloride - C2 H5Cl
Methyl Formate - C2 H4O2
Trichloromonofluoromethane (Freon 113 - Carrene No. 3) C2Cl3F3
Methylene Chloride (Carrene No. 1) CH2Cl2
Dichloroethylene (Dielene)
Trichloroethylene - Di 48) C2 H2Cl2
Trichloroethylene - C2 HCl3

CHART SHOWS for most common refrigerants actual temperatures corresponding to given condenser and evaporator pressures. Scale at left is in lb per sq in. absolute pressure; gage pressures are given at right to save converting.

For example, at 100 F, ammonia head pressure is about 210 lb abs, and methylene chloride at the same temperature is below atmospheric pressure at 4 in. Hg vacuum. In the low-temperature range, say 10 F, methylene chloride runs at 27 in. vacuum, while Freon 12, most common refrigerant for air conditioning, operates at 15 lb, g.

© POWER

The COPES "5-STAR" BALANCED VALVE



★1 The horizontal rotating lever shaft reduces friction to less than 2 pounds in the largest sizes, compared with from 6 to 16 pounds or more with a sliding stem.

★2 High valve lift, from 5/8-inch on 3/4-inch valves to 1 3/8 inches on 6-inch, permits more accurate control and increases the life of the inner valve parts.

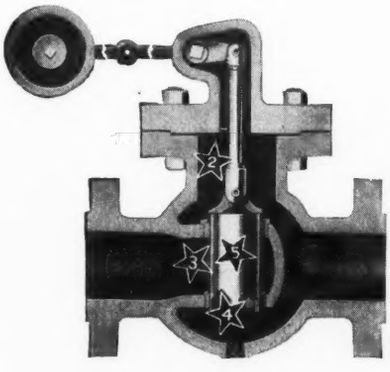
★3 Sleeve type or bevel-seating piston furnished as required by the operating conditions.

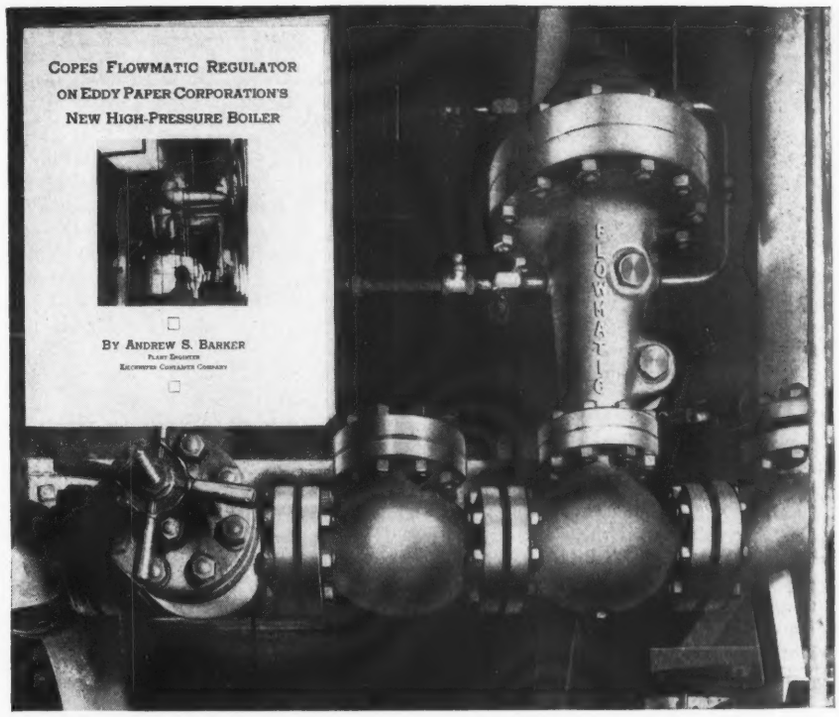
★4 Rectangular, "V" or compound ports are accurately designed for the operating conditions.

★5 Valve piston is scientifically balanced under flows and pressures, more so than any other make of "balanced" valve.

This "5-Star" Balanced Valve can be furnished for use with any actuating element. Or complete with solenoid, thrustor or motor for remote electrical control. Or with diaphragm operator for remote control by gas or air. For complete information—

Write for Control Catalog





FROM A REPORT ON THIS FLOWMATIC INSTALLATION:

"very stable boiler water level, with no more than routine care."

Add Eddy Paper Corporation to the fast-growing list of well-satisfied COPES Flowmatic users. On a 500-pound Badenhausen Steam Generator—average efficiency, 83 per cent—the Flowmatic feeds correctly for all loads and holds a very stable water level, with no more than routine care. There has been no operating or maintenance problem of any kind, no need to supplement the fully-automatic Flowmatic with any sort of manual control. For a complete description of this plant, write for Bulletin 421. For effective feed control for your modern boiler, specify the simplified COPES Flowmatic.

NORTHERN EQUIPMENT CO., 101 GROVE DRIVE, ERIE, PA.

Feed Water Regulators, Pump Governors, Differential Valves
Liquid Level Controls, Reducing Valves and Desuperheaters

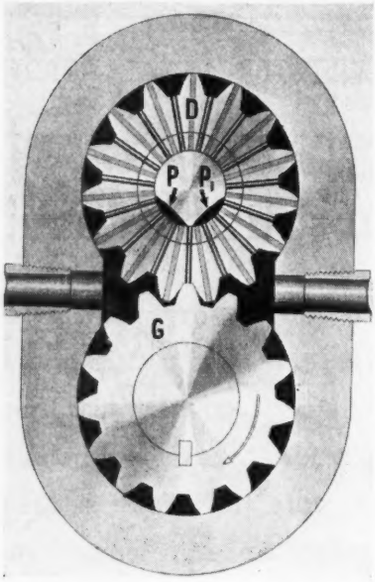
BRANCH PLANTS IN CANADA, ENGLAND, FRANCE, GERMANY AND ITALY
REPRESENTATIVES EVERYWHERE

★ GET CLOSER LEVEL CONTROL WITH THE COPES FLOWMATIC REGULATOR
FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

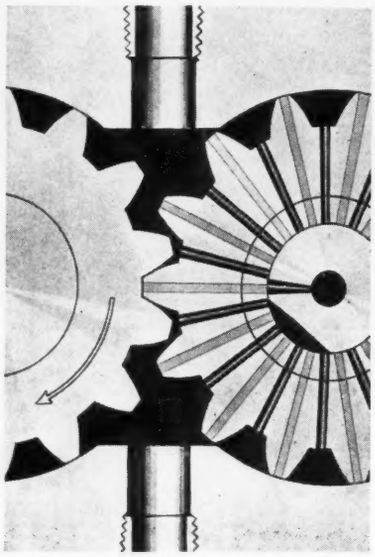
What's New In Plant Equipment

Rotary Pump

SPUR-GEAR ROTARY PUMP (below) has several special features. Its gear teeth are so formed that a rolling action takes place between them over substantially their whole contacting area. Their form also eliminates fluid slippage between the teeth and insures positive displacement. Driving gear *G* is keyed to its shaft while driven gear *D* rotates freely on its shaft, which has fluid directing grooves *P* and P_1 machined into it. Radial fluid holes to the tops and roots of the teeth of the driven gear permit the return of fluid trapped between the teeth, to the discharge of the pump through port *P*. This feature allows each tooth to completely fill the space between mating teeth without building up excessive pressure that would overload the bearings and cause noisy operation. Ordinarily when such close mating teeth start to separate a vacuum would be created. This



is prevented, however, as fluid from the suction chamber of the pump can freely flow through port P_1 and up between the parting teeth. On a constant-displacement type pump the shaft in the driven gear is fixed in the position (above) to give the most efficient operation. For the variable-displacement type, the shaft in the driven gear is arranged so that it can be turned through an arc of a few degrees. If, in (above), this shaft is rotated clockwise through a few degrees, a direct passage is had through the holes in the teeth and port *P*, allowing flow of fluid from discharge back to the suction. By this method, pump discharge can be varied over a range from full to about 66% of full capacity. A third arrangement of this pump has a hollow shaft with ports connecting with those in the gear teeth (below). The hollow shaft provides a

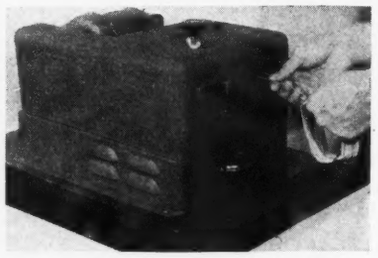


second discharge from the pump, flow from which can also be varied by turning the shaft through a small arc. With the shaft in the position shown, only the fluid trapped in the gear teeth will discharge through the shaft. By turning the shaft clockwise, the shaft ports will be supplied with fluid from the pump discharge through holes in the gear teeth. Flow from the shaft can be varied from about 10 to 30% of the total capacity of the pump. This arrangement gives the service of two pumps in one. For example, the main discharge may be used to circulate large quantities of a fluid at a low pressure, while the shaft port supplies a small quantity at comparatively high pressure. These pumps include patented features of tooth construction and are suitable for pressures up to 1000 lb per sq in. Available in 6 sizes, according to width of gear face. Operates between 50 and 750 rpm, and covers range from 1 to 25 gpm.

John S Barnes Corp, Rockford, Ill.

Wire Stripper

IDEAL No. 9-C strips cotton and enamel, silk and enamel, string, asbestos, and other light insulations from round, flat, rectangular solid or stranded wire. Said to be specially effective in cleaning fine "Litz" wires, in removing gummy insulation imbedded in stranded wires, and in cleaning new "Formex" magnet wire. Op-

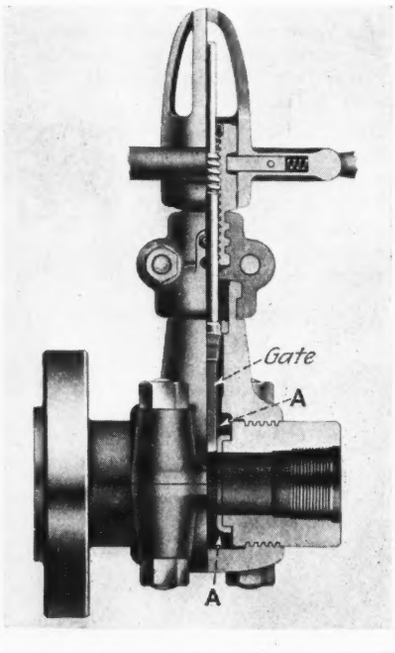


eration of stripper is from ¼-hp motor to special steel wire brushes. Speeds of brushes synchronized through auxiliary, flat-belt drive which also operates the vacuum exhaust, which in turn sucks stripped insulation into waste can.

Ideal Commutator Dresser Co, 1025 Park Ave, Sycamore, Ill.

Gate Valve

"FLEX-SEAT" gate mud valves are designed to handle any grit-laden fluid. Valve body split horizontally with threaded-in connections, (see illustration). Gate moves in and seats on a resilient insert, *A*, that resists effects of grit-laden fluid and is said to last about five times as long as metal insert. Within certain limits, as



gate or seat wears, insert flexes and still makes tight seal with gate. Foreign material trapped between gate and seat is

Insulating Firebrick

K-16 brick made of special Georgia kaolin said to maintain structure, show negligible shrinkage, and withstand loading without deformation at temperatures up to 1600 F for direct exposures and 2000 F for backing up. Average weight of material is approximately 19 lb per cu ft.

Babcock & Wilcox Co, 85 Liberty St, New York, N. Y.

Industrial Cleaner

COLD IMMERSION cleaner said to be fire-safe, non-toxic and non-corrosive. Removes dirt, grease, carbon and gum; loosens paint and lacquer, but is said not to pit or blacken any metal or alloy. Cleaner is used cold, articles to be cleaned being immersed and left. After operation is complete, article is removed and rinsed.

Bendix Products Div, South Bend, Ind.

THE MYSTERY* OF THE FLUTTERING DISC

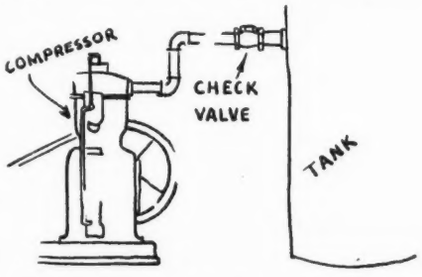
SOLVED WITH PREVENTIVE MAINTENANCE

"Why in blazes," asked the SUPER., "does that air compressor run all the time for a part-time job?"

"For the love of Mike," said the P. A. "This is the fourth time we've replaced that air line valve."

"This looks like a case for Preventive Maintenance," said the CRANE REPRESENTATIVE. "And Crane can supply the check valve you really need."

THIS conversation between the Superintendent, the P. A. and the Crane man isn't on record, but the facts are: The installation was a simple one as the sketch here shows: a common swing check valve in an air line, between compressor and storage tank —in a regional automobile assembly plant. But, the valve wouldn't hold tight—it required much too frequent



replacement. And in the meantime, the compressor panted along, doing twice the work it needed to—for those swing checks started leaking long before they actually gave up the ghost.

Ordinary maintenance would have again replaced like with like. But the Superintendent saw that Preventive Maintenance—as suggested by W. F. W., the Crane salesman, was necessary. It counseled stopping the trouble at the source: eliminating a valve in which the disc could flutter itself to pieces in the pulsating flow of air from the compressor, replacing not with another swing check valve, but with a cushioned disc check valve.

Results: (1) No further replacements even after five years, (2) a tight valve that holds air, keeps the compressor inactive except when service uses demand air, (3) one more manufacturer who has learned the economy of Preventive Maintenance and of looking to the Crane line for just the right valve for the job —of looking to the Crane salesman for the information needed for correct valve application.

* *This case is based on an actual experience of a Crane Representative in our Chicago branch. Names available on request.*

PREVENTIVE MAINTENANCE COUNSELS

Crane Cushioned Disc Check Valves

In any service—steam, water, air, oil or gas, where pulsation is severe, these Crane piston disc check valves will absorb the damaging effects of the flow. A dashpot formed above the piston effectively cushions the disc with each pulsation. For pressures up to 300 pounds steam at 550°, your best bet is this Crane 366E with both body and disc of Crane Hard Metal —a copper-tin bronze of high wear-resisting quality. Can be reground without removing body from line. In sizes up to 3″—with screwed or flanged ends. See page 36 of your Crane No. 52 Catalog.

1940 — 85th YEAR

CRANE

CRANE CO., GENERAL OFFICES
836 S. MICHIGAN AVE., CHICAGO

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

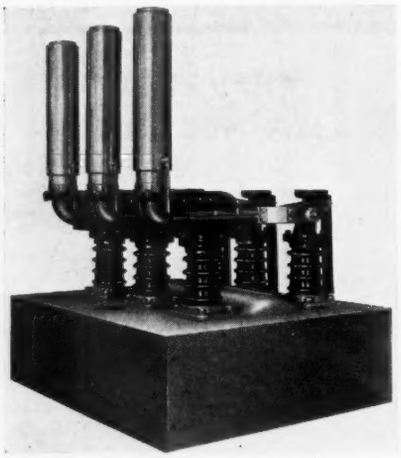
NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

imbedded into seat when gate closes and tight seal is obtained. Cost of repairing valve low because resilient insert is easily replaced. Rubber is generally used when fluid passing through pipe is not injurious to it. For fluids containing oil, gas and other substances injurious to rubber, Neoprene inserts are used.

Cameron Iron Works, Houston, Texas.

Oilless Circuit Breaker

TYPE AB-15-500 oilless breaker uses prestored energy of compressed air for the functions of breaker operation and arc interruption. Consists essentially of an air storage tank containing compressed air, a main air blast valve, three interrupting chambers mounted upon hollow insulator supports, three exhaust mufflers and isolating contacts connected in series with the interrupting chambers, also mounted on insulator supports. Interrupting process is initiated by admitting compressed



air to the interrupting chamber through the air blast valve. The compressed air operating against a piston attached to the movable contact causes the contacts to separate, thereby providing an outlet through which the compressed air escapes into the cooling chamber. As the contacts separate, an arc is drawn, which is immediately enveloped and centralized by the action of the air blast. Extension and centralization of the arc automatically connects a resistor in parallel with a portion of the arc, eliminating high-frequency transients and reducing the rate of recovery voltage.

Allis-Chalmers Mfg Co, Milwaukee, Wis.

Cement

VULCALOCK cement is not rubber, but Thermoprene, patented thermoplastic made by chemical alteration of rubber, which has consistency of light engine oil. According to manufacturer, cements have strength of bond ranging from 10 to 500 lb psi, depending on method of application and materials joined. Cements also said to resist cracking by bending, shock or variations in temperature, and to have chemical resistance better than rubber.

B F Goodrich Co, 460 S Main St, Akron, Ohio

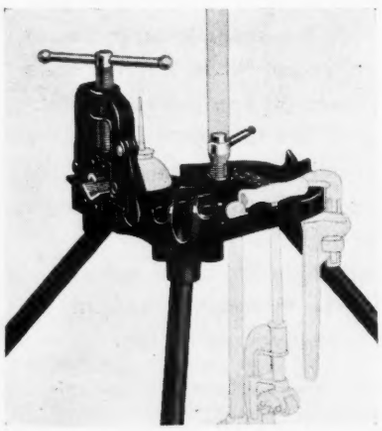
Three-Button Control Station

HAVING tongue-and-groove design of seams between enclosure base and cover to make it difficult for dirt and grit to enter, three-button control station is available for mounting horizontally or vertically. Button mechanism is of the unit-type construction, mounted in die-cast box which is open at front and two sides and has conduit opening at one end. Double-break silver alloy contacts are mounted in individual chambers in molded plastic block to protect them against injury. Unit available with various button markings, including: "Forward-Reverse-Stop," "Raise-Lower-Stop," "Up-Down-Stop," "Open-Close-Stop," etc.

Allen-Bradley Co, 1311 S 1st St, Milwaukee, Wis.

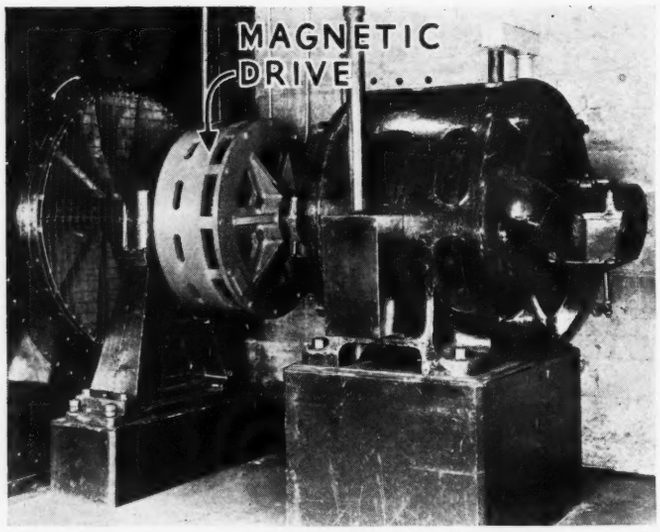
Pipe Vise

"RIDGID" vise comes complete with three-legged stand, balanced to prevent tipping and hinged so that it can be folded for convenient handling. Tray is wide, providing space for tools, dope pot, etc, and



included is pipe rest and three different size pipe benders. Vise is equipped with ceiling-brace adjustable screw for holding unit rigid while in use.

Ridge Tool Co, Elyria, Ohio.



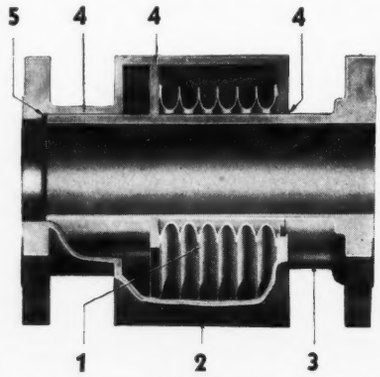
Magnet Drive

"E-M MAGNETIC DRIVE" uses electromagnetic principles for torque transmission. Is a rotating device to provide controllable, variable speed, and consists of two simple compact rotating parts, a flux linkage ring, and a magnetic flux producer. The ring is driven by the driving motor; the magnet revolves within the ring and drives the load shaft. There is no mechanical torque connection between the ring and the magnet, the torque being transmitted by electromagnetic forces, through an air gap between ring and magnet. The torque transmitted by the magnetic drive, and the speed of the load shaft, is dependent on the magnetic flux in the air-gap. This magnetic flux is varied by adjusting with a rheostat, the small control current to the magnet.

Electric Machinery Mfg Co, 1331 Tyler St, N E Minneapolis, Minn.

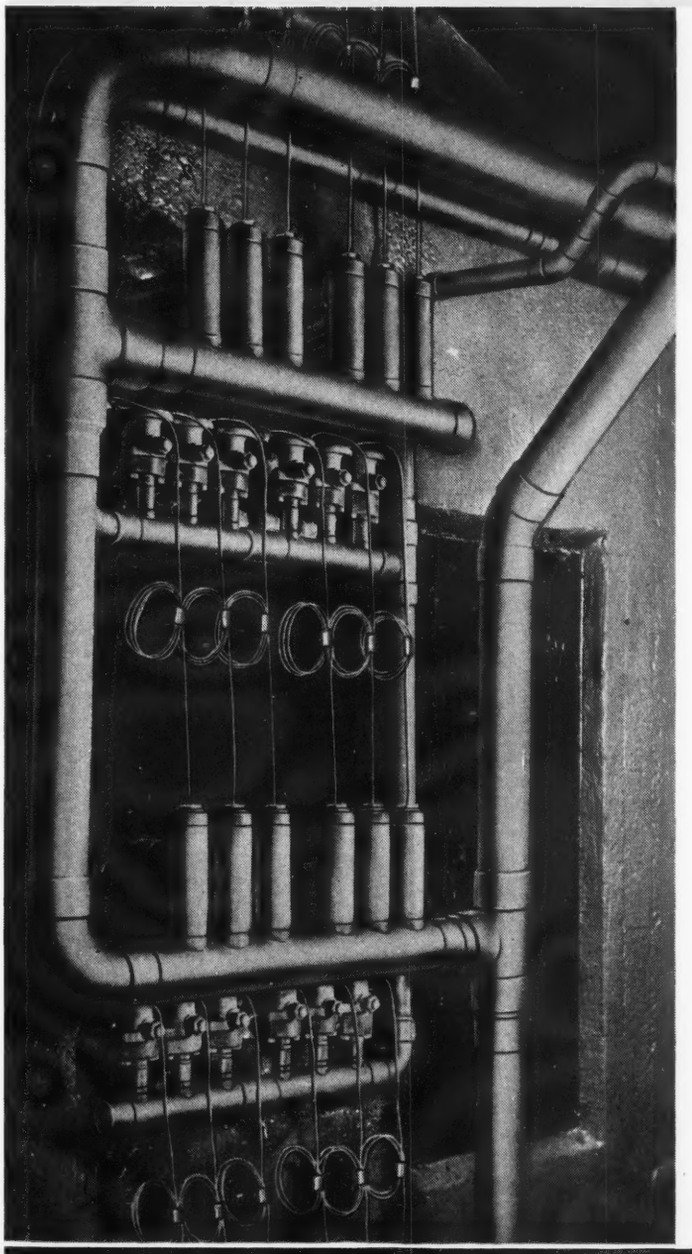
Expansion Joint

ADSCO PACKLESS expansion joint, U-ring type, is for high- and low-pressure and temperature services, steam and hot-water lines. Expansion element (1) in illustration is series of welded U-rings or cor-



rosion-resistant steel which is welded to the steel body (2) and the guide (4) on the movable sleeve (3) to form a permanent seal between the stationary body and the movable sleeve. Element is compressed axially or cold-sprung one-half of the total traverse for installation in the cold line.

Copper Offers...



Permanent freedom from rust, light weight, simplified installation and unusual adaptability... all at low cost

ALL this means that Anaconda Copper Tube is the most economical piping material for countless industrial applications in plumbing, heating, refrigeration and air conditioning, and in lubrication, fuel and process fluid conveyance.

Assembled with solder-type Anaconda Fittings, complete cost of a copper tube installation in the commonly used sizes is about the same as that of a rustable job. That means real economy over the years.

Furthermore, copper tubes, available hard or soft, are readily adaptable to complicated layouts. They are relatively easy to bend, and joints may be made in close quarters where there isn't room to swing a wrench. This can mean important space savings.

So consider copper for your next piping job. And remember that Anaconda Copper Tubes and Fittings are readily obtainable from leading wholesale distributors throughout the country. 3918-A

ANACONDA from mine to consumer

Anaconda Copper Tubes

THE AMERICAN BRASS COMPANY, General Offices: WATERBURY, CONNECTICUT

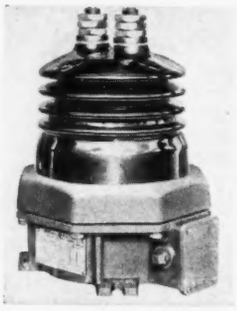
Offices and Agencies in Principal Cities • In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

As the line expands with the application of heat, the compression in the element is relieved and it passes through the neutral position into tension for the remaining half of the traverse. Joint is guided at three points (4) and a limit stop (5) prevents overtravel.

American District Steam Co, 70 Bryant St, N Tonowanda, N. Y.

Outdoor Current Transformer

PYRANOL-FILLED outdoor current transformer is of porcelain-shell type, adaptable for either horizontal or vertical mounting. Core and coils are mounted in shallow cast-iron tank and extend up into porcelain housing which acts as high-voltage bushing. High-voltage terminals are



threaded studs mounted on top of porcelain shell. Secondary terminals are fixed studs inserted in compartment in the base, and are sealed in glass at the point where they enter the tank. Pyranol is non-inflammable insulating liquid with high dielectric strength. Insulation said not to sludge, provides no fire hazard, and is hermetically sealed.

General Electric Co, Schenectady, N. Y.

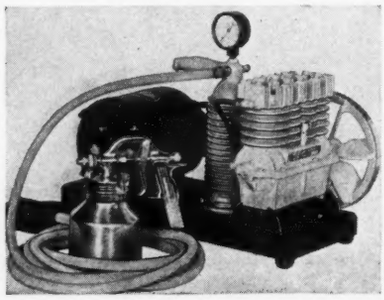
Power Rectifier

"EXCITRON" rectifier is single-anode type, as differentiated from multi-anode type. Instead of having numerous anodes in one vacuum chamber, unit has six individual chambers, each with single anode and corresponding cathode. Tanks are externally cooled with water. Frame which usually holds six tanks also supports vacuum pumping equipment which is connected to the tank through a vacuum pipe manifold. Arc-ignition and control equipment is also mounted and wired on this frame.

Allis-Chalmers Mfg Co, Milwaukee, Wis.

Portable Air Compressor

EMPIRE portable units are small units used as compressors for paint spraying purposes. Model 4 has four cylinders and model 2, two. Unites are cooled by fan-blade type of flywheel and by fins in



cylinder block and air conditioning unit. Air-cleaning chamber filters the air and removes impurities. Valves are stainless-steel disk, heat treated, and rust resisting. Largest unit gives 3.7 cfm at 60 lb.

Empire Compressor Mfg Co, Reading, Cincinnati, Ohio.

Gouging Nozzles (1)

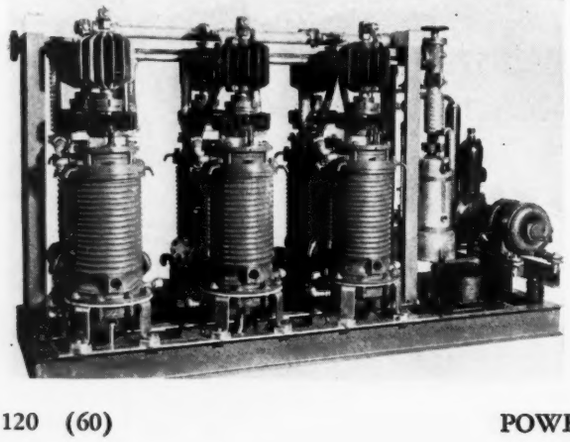
"OXWELD" nozzles provides means for removing a narrow strip of surface metal from steel plate, forgings, and castings. Nozzles are designed to deliver a relatively large jet of oxygen at low velocity. By proper manipulation of the blowpipe in which the nozzle has been inserted, a smooth, accurately-defined groove can be cut or gouged out of the surface of the metal. Illustration shows blowpipe with three standard nozzles available.

Linde Air Products Co 30 E 42nd St, New York, N. Y.

Arc Torch (2)

DESIGNED to offset the handicap of lack of suitable attachments for doing heating and welding jobs that demand an independent source of heat, torch will operate from any ac machine. Said to be applicable to welding aluminum, as hot, soft, easily controlled flame is ideal for the purpose. Comes with cables, carbons, carbon adaptors, copper terminal lugs, and 2 regular taper jacks.

Marquette Mfg Co, 409 Johnson St, N E, Minneapolis, Minn.

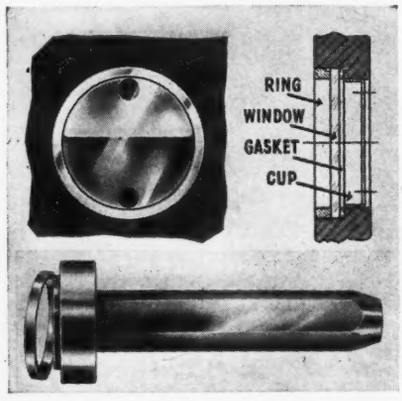


(1)

(2)

Oil Window

GENERAL-PURPOSE oil window is self-contained unit offered for use in conjunction with oil reservoirs, containers and lubricators. Comes as a ring, which is chromium plated, with polished face pressed flush, window, gasket and cup, all fitted into metal pocket. Drilled opening at top

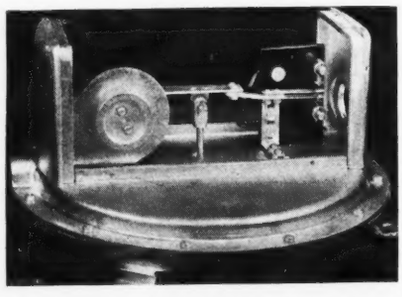


of cup and another at bottom permit free passage of oil. Bright aluminum background of cup acts as reflector which gives sharp visibility of oil level, even under imperfect lighting conditions.

Bijur Lubricating Corp, 43-01 22nd St, Long Island City, N. Y.

Air and Gas Regulator

"STATICTROL" is low pressure air and gas regulator for positive pressures, and has been designed to produce a control sensitive enough for combustion control, but with enough capacity for gas- and air-duct control. Capacity is from 0 to 2 in. water column pressure, and differential adjustment may be from .01 to 1 in. water column pressure. Has cast aluminum case,



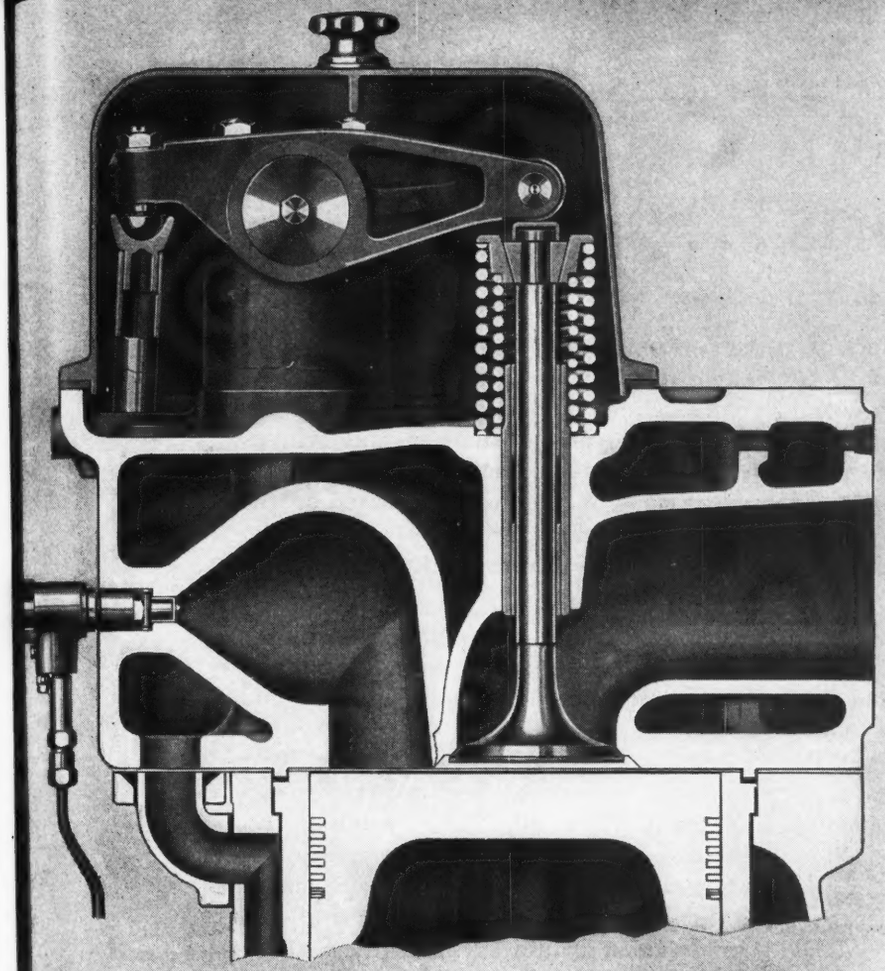
Neoprene diaphragm, with eccentric adjustment for positive or negative pressures and differential adjustment.

Automatic Control Co, 2590 University Ave, St. Paul, Minn.

Oygen Analyzer and Recorder

INSTRUMENT introduces new principle in measurement and is designed for permanent installation and continuous operation. Can be used to control oxygen content in chemical processing, to measure oxygen in hydrogen atmospheres used in

(*Continued on p* 124)



for

IMPROVED COMBUSTION

The Exclusive

DE LA VERGNE COMBUSTION SYSTEM

• Of major importance is the De La Vergne Combustion System. The intimate mixture of air and fuel—high turbulence—assures uniform and clean combustion and, due to inherently good cooling, sticking of the spray nozzle and the injection nozzle cooling problem are eliminated.

The De La Vergne System with a controlled-turbulence combustion chamber and a multiple-opening spray nozzle permits injection of fuel over a longer period, at lower injection pressure, which means considerably lower firing pressure rise per degree of crank travel, and low maximum combustion pressure. The result—exceptionally smooth performance and quiet running.

With this exclusive combustion system, De La Vergne Diesel Engines are less sensitive to variation in fuel oil characteristics, without sacrifice of clean, smoke-free combustion.

BLW THE BALDWIN GROUP

DE LA VERGNE ENGINE CO.

Subsidiary of THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

Man's Seasons . . .

THE OLD ROMANS, who began lots of things, also started our calendar. At first it had only ten months, beginning with blustery March which they named after their war god, Mars. They ran out of gods about mid-year though, so named the latter months simply September, October, November and December after the Latin words for seven, eight, nine and ten.

It was Julius Caesar who realized that something was wrong. He figured it was better to have twelve months, to correspond with the twelve cycles of the moon during one of the sun. But here he struck a snag, for the moon's cycle was 29 days, a total of 354 for the year, and the sun took 365¼ days to get the earth around it.

That didn't stump Caesar for long—he decreed that every other month starting with January was to have 31 days, and the others 30 apiece, except February, which in three out of four years was to have only 29. That was agreeable to everybody but Augustus Caesar, who not only had to have the eighth month named after himself because Julius named the seventh, but also wanted his month as long as Julius'. So February lost another day, and the latter months of the year were all switched around to avoid three 31-day months in a row. In those days, kings were KINGS.

Hundreds of years before the Caesars though, a Greek named Hesiod had told his fellows to plough and sow when they heard the migrating cranes cry, to stop digging in the vineyards when the snails climbed the vines, to be assured of summer when the thistle bloomed, to wait for sprouting of the fig-trees before they put to sea. In spite of our weather bureaus, we still help the groundhog watch for his shadow, hunt for the first bluebird or robin, still expect twice a year to mark a season by the flying vee of honking geese.

For always, since time began, the changing seasons have had power over man. Their number even varies with the particular climate. The old Teutons recognized only spring, summer and winter. East Africans and East Indians have only two seasons, in the first case based on the two rainy periods, in the second on the half-year change from northwest to southwest monsoon.

In America, we now start another year with January, named after the 2-faced god who is forever looking both forward and backward. Like him we look back at a year finished, ahead at one to come. This season of doing our best to keep steam going any way at all, then a Spring during which we have snatches of time to get things up to snuff again, a slow Summer, and a busy Fall when we remember all the things which should have been done three months before!

Perhaps we engineers are as close to old Mother Nature as any other profession —principally because we spend so much of our time counteracting her effects, warming our fellows during the cold months, cooling them during the hot ones. We've turned Nature's whole scheme of things inside out, for we're busiest when she's dormant, and resting when she's getting in her best licks.

But the rest of the world wakes up and gets going in the Spring with nature, so while they're sleeping, we can get some thinking and planning done and be ready to lay finished plans on the line when the geese fly north again. If we're going to rest during the summer, let's get our planning done now!

George Edwards

Engineer

KEEPING 'EM ROLLING — By WESTCOTT

WELL, MAYBE WE GET HOME FOR DINNER A COUPLA NIGHTS NOW
MAYBE NOTHING! WE WON'T HAVE ANY TROUBLE ON THIS JOB FOR A GOOD LONG TIME

J-M MOGUL VALVE STEM PACKING: This specially lubricated packing stays soft and pliable . . . prevents trouble throughout its long life.

JOHNS-MANVILLE PRODUCTS **Johns-Manville**

HOW THEY DO IT . . .

Use Packing Built to Stand Up

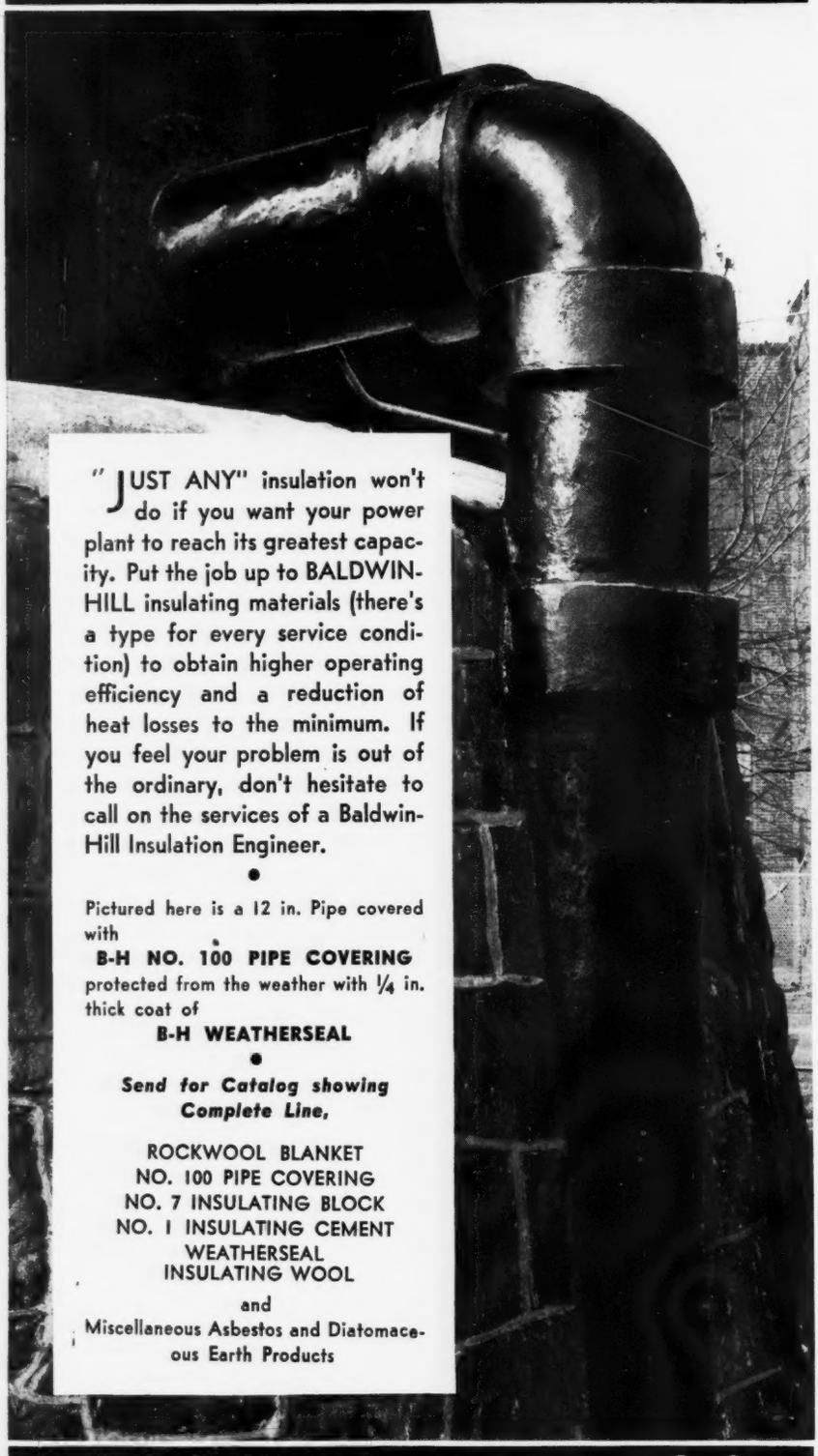
YOU'D be getting off easy if materials were the only expense on a packing job. But it's labor and general shutdown charges that cost the real money. And those are the losses that J-M Packings reduce the most. Our present line is the product of more than 60 years' experience and research. It contains a packing for every purpose. Users tell us that these materials last longer, give more efficient service, keep shutdowns at a minimum. You should have all the facts. Write for a copy of the J-M Packing Catalog. Johns-Manville, 22 East 40th Street, New York, N. Y.

PACKINGS & GASKETS

THERE'S A DISTRIBUTOR NEAR YOU

BALDWIN-HILL

Heat Insulation Products



"JUST ANY" insulation won't do if you want your power plant to reach its greatest capacity. Put the job up to BALDWIN-HILL insulating materials (there's a type for every service condition) to obtain higher operating efficiency and a reduction of heat losses to the minimum. If you feel your problem is out of the ordinary, don't hesitate to call on the services of a Baldwin-Hill Insulation Engineer.

•

Pictured here is a 12 in. Pipe covered with

B-H NO. 100 PIPE COVERING

protected from the weather with ¼ in. thick coat of

B-H WEATHERSEAL

•

Send for Catalog showing Complete Line,

ROCKWOOL BLANKET
NO. 100 PIPE COVERING
NO. 7 INSULATING BLOCK
NO. 1 INSULATING CEMENT
WEATHERSEAL
INSULATING WOOL

and

Miscellaneous Asbestos and Diatomaceous Earth Products

BALDWIN-HILL CO.

575 KLAGG AVE. . . . . TRENTON, N. J.

New Equipment

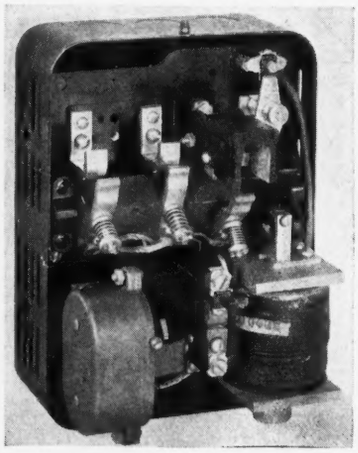
(Continued from page 120)

hydrogenation operations, to measure oxygen content of natural, coke-oven, and blast-furnace gases, and to measure excess air in products of combustion from burners of various types. Recorder supplies precise measurement of oxygen concentrations from 0 to 15% and can be calibrated for any range between these limits.

Mine Safety Appliances Co, Pittsburgh, Pa.

Definite-Time Starter

TYPE CR4052-A1A starters are mounted on molded Textolite base with a Class 115 starting resistor on the back. Unit is dc definite-mechanical-time starter for general-purpose constant-speed motors where jogging is not required. Has rating up to 5 hp, 115 v and 10 hp, 230 volts. Has

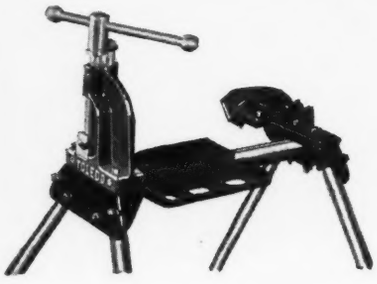


solenoid-operated multifinger contactor with an overload relay. New isothermic overload relay makes possible improved overload protection, works on the heater and bi-metallic strip principle, and is easily set for either manual or automatic resetting after overload.

General Electric Co, Schenectady, N. Y.

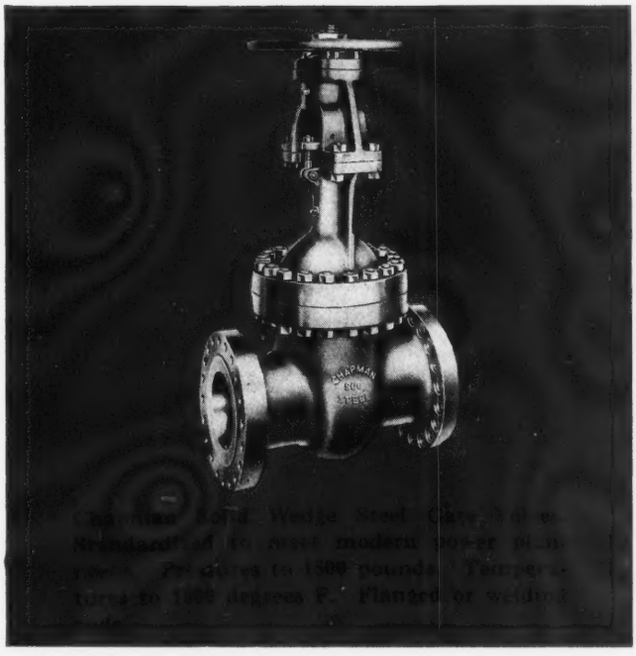
Stand and Vise

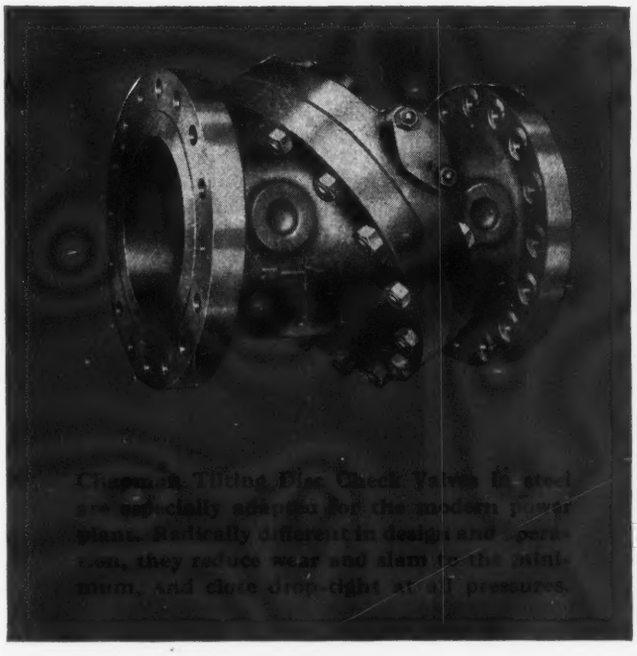
"HANDY STAND" has open vise with capacity ⅛- to 2½-in. pipe, with tool tray and pipe bender with capacity up to 1-in. pipe or conduit. Stand can be furnished with or without the vise, tool tray, or bender. No legs or connecting piece are furnished,



Chapman Valves

For Power Plant Requirements

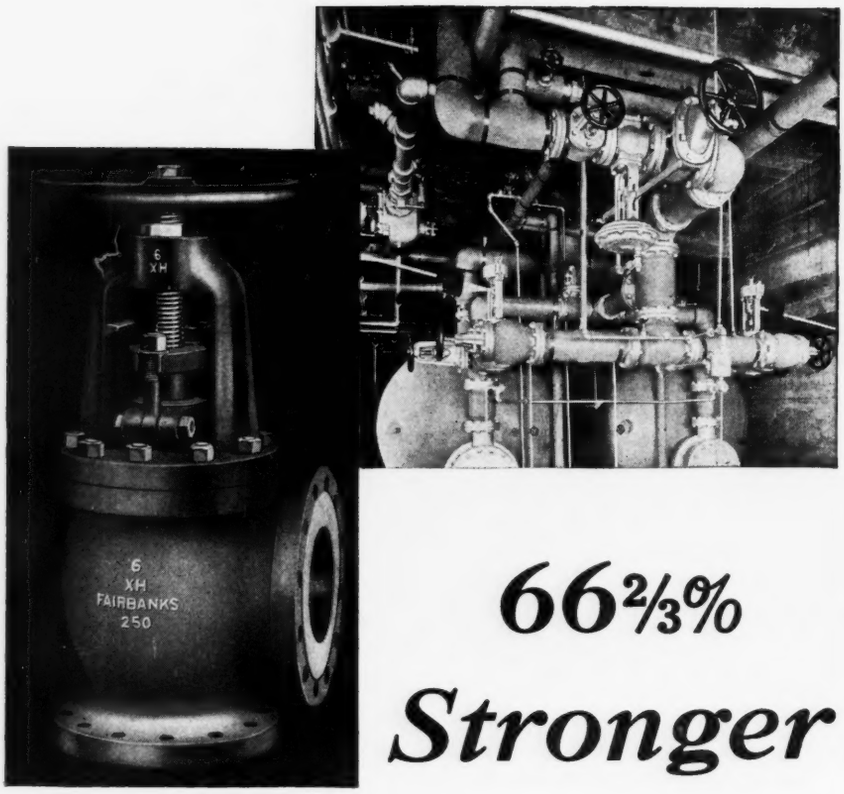




THE CHAPMAN VALVE

MANUFACTURING COMPANY

INDIAN ORCHARD, MASS.



66⅔% Stronger

Fairbanks Iron Valves are made of a special high-test alloy iron which has a tensile strength of 40,000 lbs. per sq. in. This is about 66⅔% greater than ordinary cast iron, giving greater strength to withstand pipe strains and sudden shocks.

The rolled naval bronze stem, with full cut Acme threads, makes the valves operate more easily. You will never have trouble opening or closing them.

When you need valves on which you can take no chances, especially for installations like the above DePaul Hospital, St. Louis, Mo.—where valve failure might curtail the water supply or fire-prevention systems and jeopardize the lives of hundreds of patients—install the dependable Fairbanks Valves.

Fairbanks Valves are made in bronze and iron for a large range of pressures, with screwed and flanged ends, in globe, gate, angle, check and cross patterns.

Write for catalog No. 21 and name of the nearest Fairbanks distributor.

THE FAIRBANKS COMPANY

Valves, Dart Unions, Hand Trucks and Wheelbarrows

397 LAFAYETTE ST., NEW YORK, N. Y.

Boston, Pittsburgh—Distributors in Principal Cities
Factories: Binghamton, N. Y., Rome, Ga.

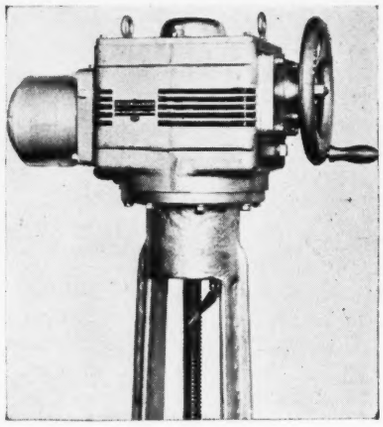
Fairbanks Iron Valves

but can be made from any length pipe operator wishes. Maker recommends that legs and center pieces be made from 1- or 1¼-in. pipe, the legs, 42 in. long and the center piece 20- to 24-in. long.

Toledo Pipe Threading Machine Co, 1431 Summit St, Toledo, Ohio.

Valve Operator

C-H VALVE-OPERATING unit provides controlled thrust action directly on valve stem, but has thrust limit switch which seats valve without jamming or damage. Consists essentially of thrust springs, which compensate for expansion and contraction of valve stem; high-torque, reversible motor; simple jaw clutch for coupling op-

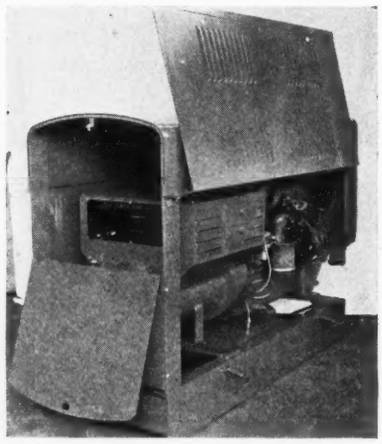


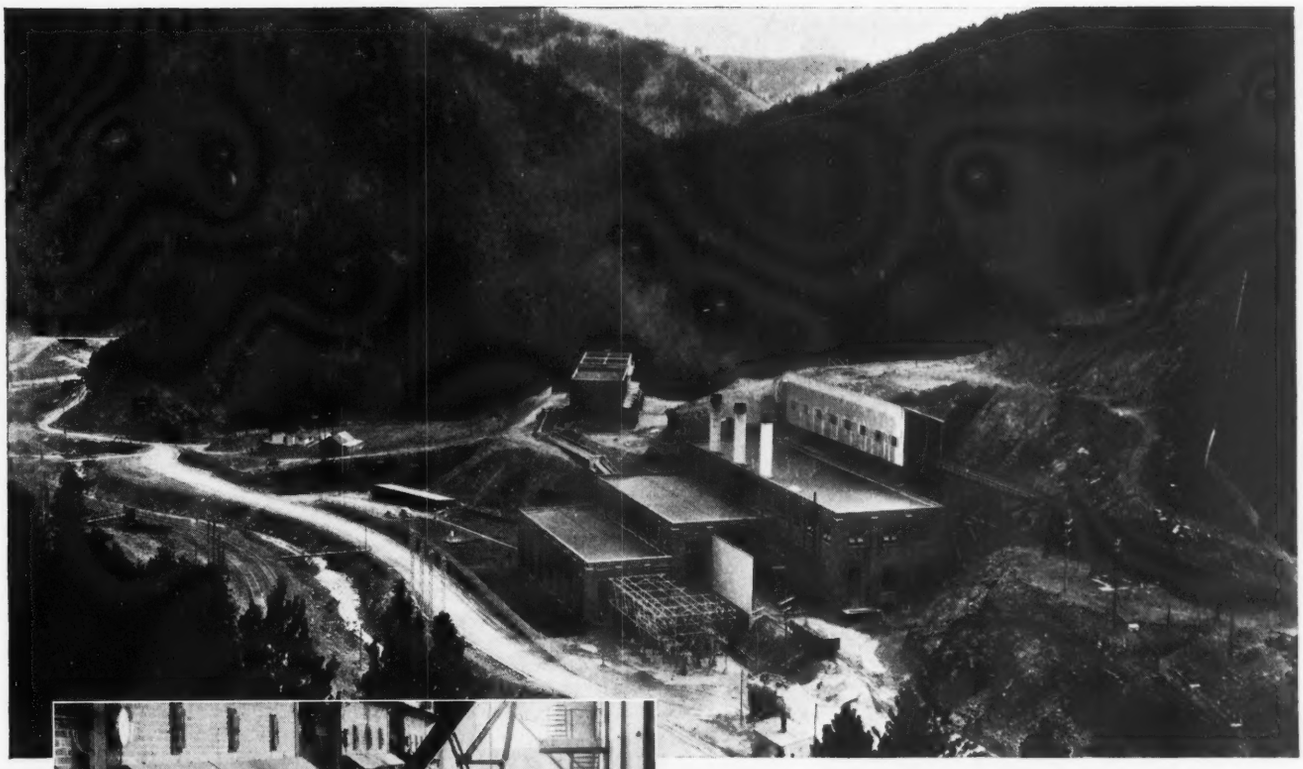
erator to yoke nut; and gear reduction, which is immersed in oil for complete lubrication. Position limit switch stops operator in open valve position, and unit is equipped with handwheel for manual operation. Can be obtained with thrusts from a few to 400,000 lb, for applications requiring a slow throttling gate speed, or an emergency quick-closing speed up to 80 in. per min.

Cutler-Hammer, Inc, 606 N 12th St, Milwaukee, Wis.

Engine-Driven Welder

"SAE-200 J" has single-operator generator, variable voltage type, with laminated pole pieces. Current range of welding is 40





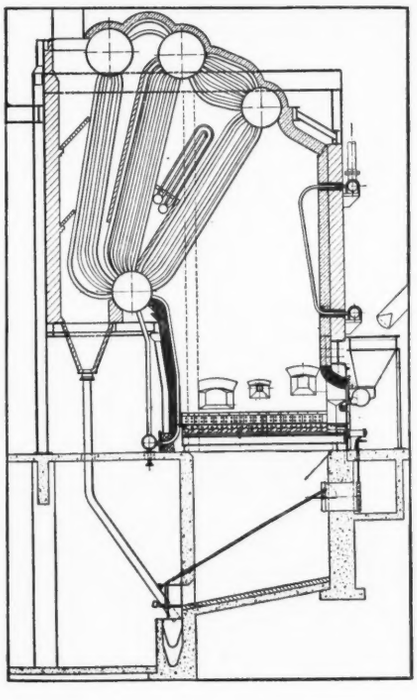
Kirk Power Station—Lead, S. D.

• • •

DETROIT ROTOSTOKERS

Selected for Nation's Largest Gold Mine

Homestake Mining Co., Lead, South Dakota



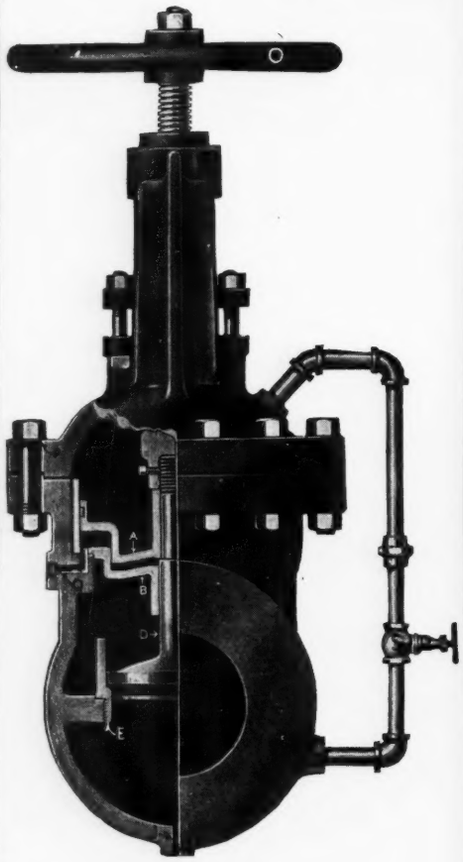
RotoStokers (Power operated, dumping grate type) applied to four drum, bent tube, boilers, 425 lbs. pressure, 700 deg. F. steam temperature, at Homestake.

Steam to generate power at Kirk Power Station of Homestake Mining Company, Lead, South Dakota, is produced by boilers (10,237 square feet heating surface each) fired with Detroit RotoStokers. • Homestake selected Detroit RotoStokers because of their ability to successfully burn WYOMING COAL of 8000 B.T.U., with moisture of approximately 30%. • RotoStokers develop high capacity and efficiency with a wide range of fuels. • Write today for the Detroit RotoStoker Catalog. Ask for Bulletin No. 830.

DETROIT STOKER COMPANY

Fifth Floor, General Motors Building, Detroit, Mich. • Works at Monroe, Mich.
District Offices in Principal Cities • Built in Canada at London, Ontario

Golden Anderson
SPECIALTY
VALVES



THROTTLE AND EMERGENCY STOP

● Protection against damage to valuable property is assured you with G-A's throttle and emergency stop valve — it automatically shuts down any overspeeding engine or turbine. Operating mechanically, electrically or by hand, it works instantly, even to being tripped by a push buttom from remote points. Maximum speeds are rigidly controlled, for no unit can exceed safe operation speed when equipped with this valve. In angle and globe patterns of 2½" to 16" in size, these quality G-A valves are in use, under every pressure, on all types of steam engines and turbines.

also

Triple Acting Non-Return . . . Pressure Reducing . . . Altitude Control . . . Float Control . . . Check Valves, etc.

For more complete details of the entire G-A line, write for free catalog today.

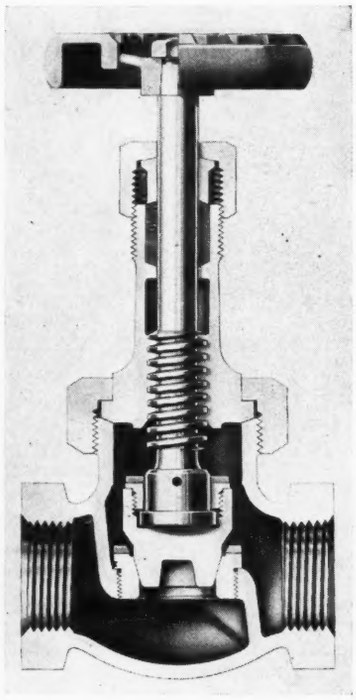
GOLDEN-ANDERSON VALVE SPECIALTY CO.
FULTON BLDG. PITTSBURGH, PA.

to 200 amp for either bare, washed or heavily coated electrode. Unit equipped with "dual-continuous-control," patented feature enabling independent adjustment of both open circuit voltage and welding current. Gasoline engine is 4-cylinder, 3-in. bore, 4-in. stroke, and capable of delivering 26 hp at 1800 rpm.

Lincoln Electric Co, 12818 Coit Rd, Cleveland, Ohio.

Globe and Angle Valves

MADE IN SIZES from ¼- to 2-in., for 200-lb steam and 550 F, and 400-lb cold water, oil or gas, non-shock; and in sizes from ¼- to 3-in. for 300 lb steam at 550 F, and 600 lb cold water, oil or gas, non-shock. Plug disk and renewable seat ring are both of copper-nickel alloy, seat rings be-



ing made of harder composition than disk. Angularity and length of the disk and seat ring have been proportioned to minimize wear at small openings, and to permit tight closure even if faces are partially damaged. Stems have 60,000-lb-psi tensile strength with standard threads and rounded stem head to allow self-centering of disk.

Kennedy Valve Mfg Co, Elmira, N. Y.

2-Cylinder Diesel

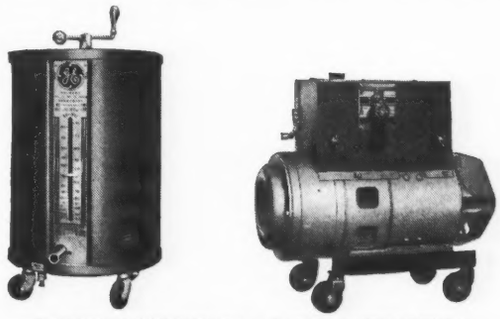
DIX SERIES, 2-cylinder diesel has all important features of larger sizes. Largest model in series develops 27 hp at 1600 rpm, has 4¼-in. bore, 4½-in. stroke, and a displacement of 127.5 cu in. All models built primarily for hand starting, and large flywheel and decompression device built into cylinder facilitate starting. Fuel pump and governor are incorporated in design of cylinder block itself. Engines have only three gears in front of the

How to do it?

Check with us—there may be a new electric way that's cheaper and better

ELECTRIC THICKNESS GAGE

Here's an improved thickness gage that is used to measure nonmagnetic films such as porcelain or lacquer on either flat or curved surfaces of magnetic materials. It's fast and accurate. Invaluable for inspections, etc. Ask us for Publication GEA-2851A.

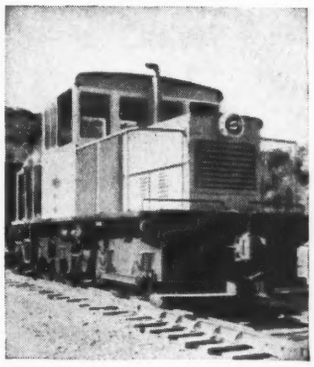


LOW-CURRENT ARC WELDERS

Both of these welders have proved themselves real money makers on the production line and real money savers on maintenance work. These two 150-ampere arc welders (a-c and d-c) will solve your light-gage welding problems. We'd like to send you our arc-welding publication, GEA-3081A.

YARD LIGHTING—PLANT LIGHTING PROTECTIVE LIGHTING

Protect your plants and provide better working conditions with G-E lighting units. There are especially designed units for platforms, for yard lighting—floodlights and searchlights, that help you get more work performed after dark. Use them to protect your plants, to save time and money. Bulletin GEA-1865 will bring you the latest news on G-E floodlights for industrials.



DIESEL-ELECTRIC LOCOMOTIVES

Here's a line of diesel-electric locomotives for work in and around industrial plants. Weights 20 tons and up. The electric drive means reduced operating expense, easier handling, longer, locomotive life, full power at all speeds. This outstanding buy in industrial locomotives is described in our leaflet GEA-3071.

General Electric, Dept. 6M-201,
Schenectady, N. Y.

Please send me more information on the products checked.

Electric thickness gage, GEA-2851A ☐ ..... Lighting
Low-current welders, GEA-3081A ☐ .....
for industrial yards, GEA-1865 ☐ ..... Diesel-electric locomotives, GEA-3071 ☐ .....

Name.....

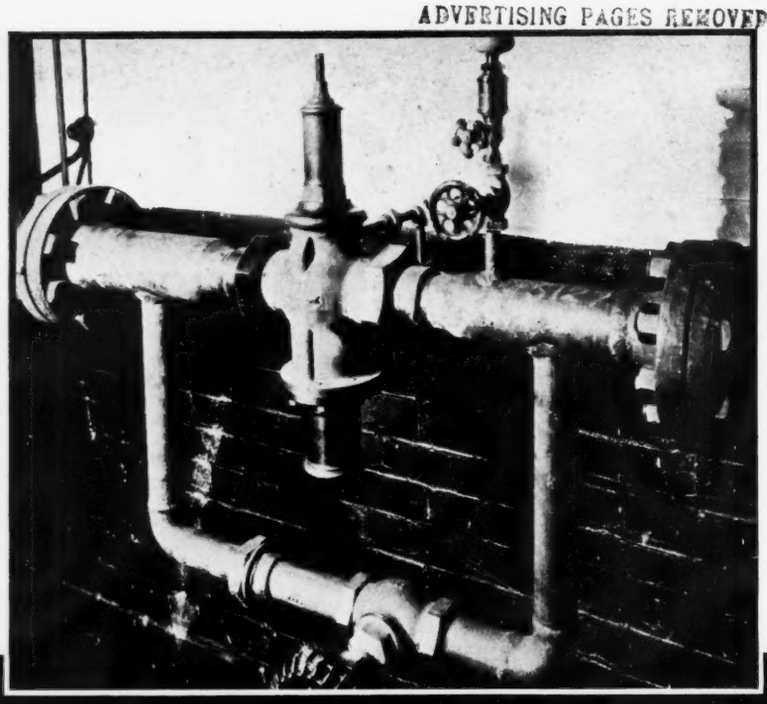
Address.....

City..... State.....

96-568

GENERAL ELECTRIC

ADVERTISING PAGES REMOVED

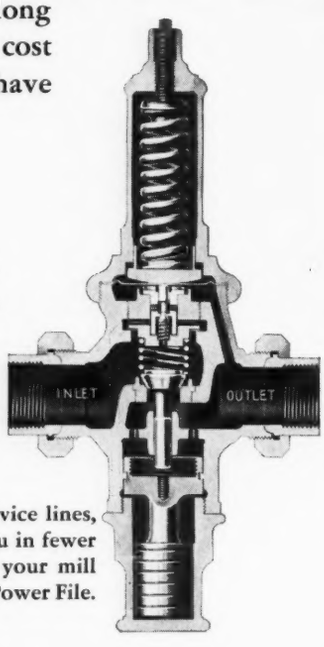


Get Dependable Control
THAT SAVES UP TO 67%

Pressure regulators that are *dependable* for *long periods* at *low maintenance cost* are the most economical even when first cost is slightly more. Which is the reason that the Masoneilan No. 11 Regulator has been the standard steam pressure reducing valve for over 50 years. Engineers like its speedy, accurate response; its long reliable service; its low maintenance cost —savings that run as high as 67% have been reported.

CHECK THESE DISTINGUISHING FEATURES:

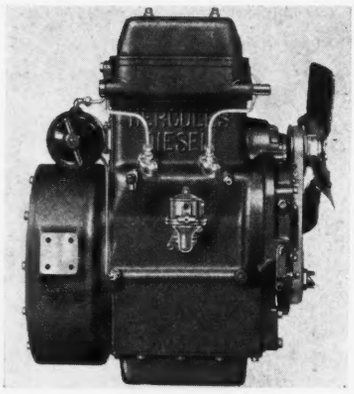
Bronze body—union connections (also made in iron or steel with flange connections). . . . Heat treated, hardened, renewable stainless steel trim at no extra cost. . . . Pilot-operated for fast, accurate response. . . . Unaffected by fluctuating demand. . . . Wide rangeability—5 to 100 lbs. or 100 to 225 lbs. reduced pressure. . . . Downstream connection for better control and greater capacity.



Before buying any reducing valve for steam service lines, check up on Masoneilan No. 11. It will pay you in fewer headaches and lower maintenance costs. Ask your mill supply distributor or see our Catalog in Sweet's Power File.

MASON-NEILAN REGULATOR CO.
1186 ADAMS ST., BOSTON, MASS.

NEW YORK BUFFALO PHILADELPHIA PITTSBURGH TULSA
TOLEDO CHICAGO ST. LOUIS HOUSTON LOS ANGELES
MASON REGULATOR CO. OF CANADA, LTD., MONTREAL, CANADA

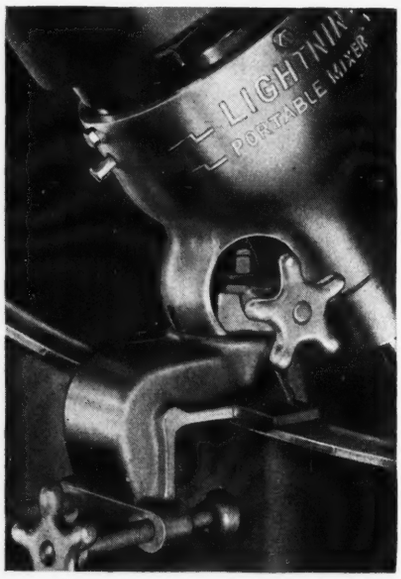


engine, these being the crankshaft, camshaft and lubricating-oil driving gear. Time-gear housing, tappet and rocket arm compartment are air-tight and sealed from the crankcase.

Hercules Motor Corp, Canton, Ohio.

Mixing Clamp

HAND CLAMP for adjusting "Lightnin" portable mixers operates by hand wheel, which locks mixer into any selected position for any mixing action. Chief feature is patented double wedge with hand wheel which tightens the unit firmly.



Double-bronze wedges, cadmium-plated king-pin and lock-nut, parkerized locking screw and aluminum handwheel prevent clamp rusting or "freezing".

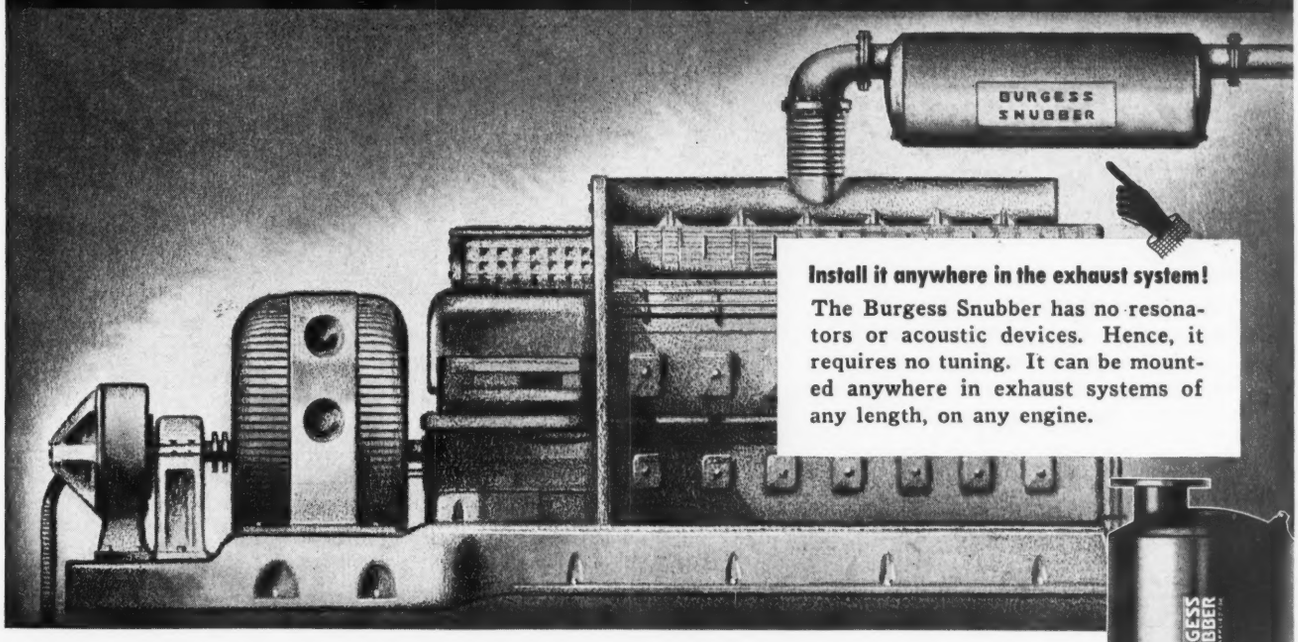
Mixing Equipment Co, Rochester, N. Y.

Storage Control

"TELLEVEL" control consists of multiple-electrode sealed mercury switch so mounted that tipping it in any direction will break the electric current. Polished aluminum bell provides dust-tight housing for switch and electric wiring. Controls are installed in such applications as hoppers (see cut), where shortage of ma-

(Continued on page 134)

You don't have to "TUNE"
this new type of DIESEL SILENCER



Install it anywhere in the exhaust system!

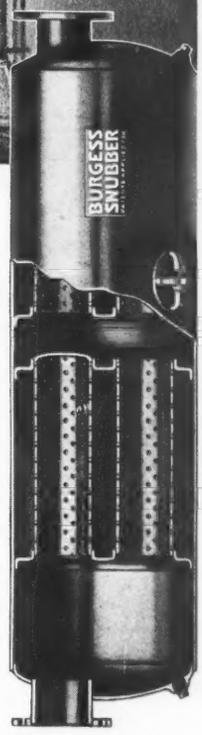
The Burgess Snubber has no resonators or acoustic devices. Hence, it requires no tuning. It can be mounted anywhere in exhaust systems of any length, on any engine.

Prevents Exhaust Noise . . . Keeps Fuel Consumption Low!

You positively prevent noise with the Burgess Snubber, regardless of the length of exhaust piping or the Snubber's location in the exhaust system. The Burgess Snubber employs a new method of preventing exhaust noise by "snubbing" the slugs of high-pressure gas and dissipating them before they detonate in the atmosphere. Thus, exhaust pipe roar is avoided. An unrestricted passage is provided for the gases exhausted during the scavenging stroke. Hence, the exhaust gas is bled off smoothly, with no back pressure peaks.

Fuel consumption is not increased and engine efficiency is not reduced with Burgess Snubbers. Unlike conventional exhaust mufflers, they do not build up peak back pressures. With the Burgess Snubber, there is no critical length of exhaust piping at which fuel consumption is increased and engine efficiency is reduced. Burgess Snubbers are equally effective for quieting two-cycle and four-cycle engines.

Burgess also offers the Spark Arresting Snubber and Intake Snubber. Mail coupon for further information.



Sectional view showing construction of Burgess Snubber.

BURGESS SNUBBERS

Patents Applied For

SEND FOR DATA BOOK

Burgess Battery Co., Acoustic Division
Dept. G 500 W. Huron St., Chicago, Ill.
Send me booklet, "Snub the Slug and Stop the Noise."

Name .....

Company .....

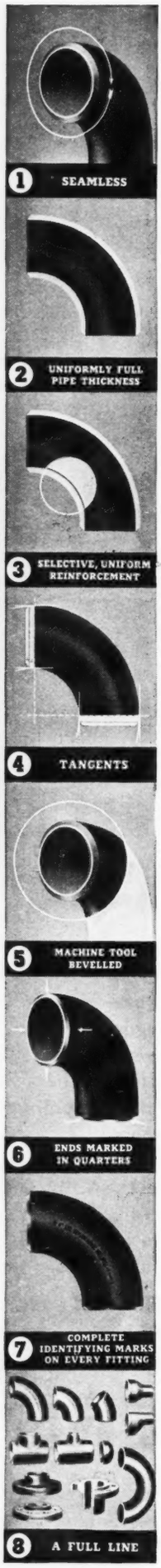
Street .....

City..... State .....

Insist upon the welding fittings that alone combine these eight features.

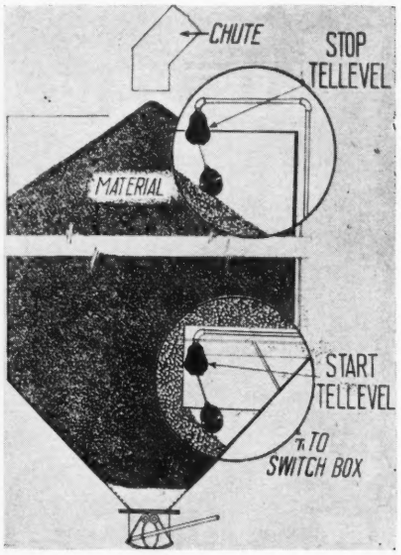
TAYLOR FORGE
★WeldELLS
Seamless Pipe Fittings for Welding
★ Trade Mark Registered

TAYLOR FORGE & PIPE WORKS
General Offices and Works: Chicago, P. O. Box 485
New York Office: 50 Church Street


1 SEAMLESS
2 UNIFORMLY FULL PIPE THICKNESS
3 SELECTIVE, UNIFORM REINFORCEMENT
4 TANGENTS
5 MACHINE TOOL BEVELLED
6 ENDS MARKED IN QUARTERS
7 COMPLETE IDENTIFYING MARKS ON EVERY FITTING
8 A FULL LINE

New Equipment

(Continued from page 130)

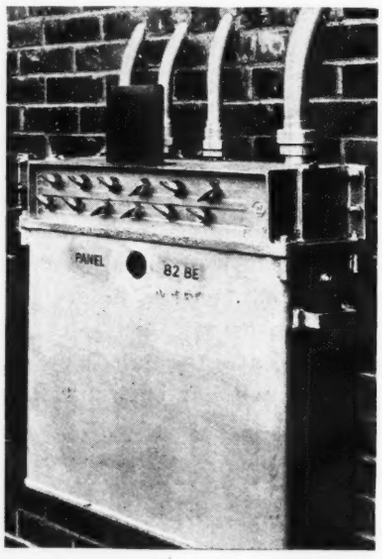


terial starts switch connected to supply source, through lower control. Hopper then fills up, and when material reaches top control, it forces bell sideways, breaking contact and stopping flow of material.

Stephens-Adamson Mfg Co, 5 Ridgeway Ave, Aurora, Ill.

Lighting Panelboards

OIL-IMMERSED panelboards, using thermal-trip branch circuit breakers, are for the protection of lighting circuits in locations exposed to corrosive elements and explosion-hazardous atmospheres. Breaker



is compensated within commercial limits perimtting zero to 10% decrease in rating when surrounding oil temperature is 140 F, and zero to 10% increase in rating at 10 F.

Westinghouse Electric & Mfg Co, E Pittsburgh, Pa.

WORTHINGTON

100 YEARS

1840 - 1940

"WHAT IS RIGHT WILL PROVE ITSELF RIGHT"

THUS WROTE Henry R. Worthington, a great engineer-inventor, in 1876. He continued, "I have asked for an answer to the question . . . Have I been able permanently to improve the department of engineering, in which I have steadily and exclusively worked?"

» Today, the company which he founded, its products in use in every country in the world, with plants that cover hundreds of acres, with the value of its manufactures reaching hundreds of millions of dollars, looks back over a century's span, and sees proved the essential soundness of its founder's vision and ideals.

» In its century of growth it has pioneered in many significant basic engineering developments of widespread application. Itself a pioneer, it has pushed forward shoulder to shoulder with pioneers, across continents and over the seven seas. It has witnessed the birth and growth of a new age. It has seen a whole new civilization develop, and has accepted the continued challenges of that civilization. Looking back on its rich and fruitful past, it turns to its second century confident of its ability to carry on with the splendid spirit and vision of its founder.

» Worthington's maturity finds expression in a notable group of engineering products with standards of excellence and records of performance unsurpassed in their respective fields . . . for the petroleum industry in production, transportation and refining . . . for gas and oil pipe lines and distribution . . . for refrigeration and air conditioning in every branch . . . for steam power, land and marine, including turbines, condensers, feedwater heaters and auxiliaries . . . feedwater heaters for railway locomotives . . . Diesel and gas engine units covering a wide power range . . . air and gas compressors for all industrial uses . . . a comprehensive line of contractor equipment . . . and pumping equipment whose scope is the most extensive available.

» It has been said that an institution is the lengthened shadow of a man. Perhaps more true of the Worthington Pump and Machinery Corporation than of most institutions, it yet is not the whole truth. This corporation is not only the lengthened shadow of one man, but of many men who have given the best of their keen minds and stout hearts, that their science and engineering could better serve not only their company but also the civilization of which they and it have been such important parts.

Harry G. Beaver

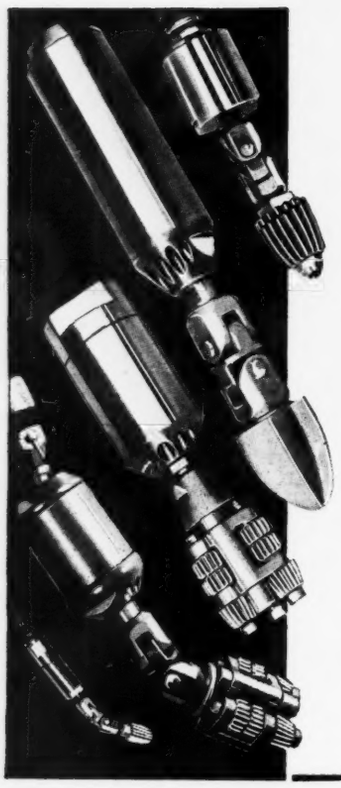
PRESIDENT

WORTHINGTON PUMP AND MACHINERY CORPORATION
HARRISON, NEW JERSEY

Moore Steam Turbine Division . . . Carbondale Air Conditioning and Refrigeration Division
Worthington-Gamon Meter Company

MIO-1

BE PREPARED for Bigger Profits in 1940 with ROTO Rapid-action Tube Cleaners



Boiler loads in 1940 promise to be at the highest levels in history. Boiler efficiency will therefore be affected vitally by scale conditions.

The 1940 Roto Rapid-action Tube Cleaners remove scale from 10% to 30% (and up to 66%) faster. The new motor design develops far greater cleaning power. An air valve directly behind the motor enables the operator himself to turn the air on and off instantly, saving time between tubes and eliminating the cost of a helper. A wide selection of heads includes self-feeding cage and swing-frame types, universal joints and 6-way drills. We can furnish cleaners for straight or curved tubes or pipes from 1/2" to 18" I.D. operated by air, water or steam.

Be prepared to set new records for speed and economy in tube cleaning with the 1940 Roto Rapid-action Tube Cleaner. Write or wire for details.

The ROTO Company

145 Sussex Ave. Newark, N. J.

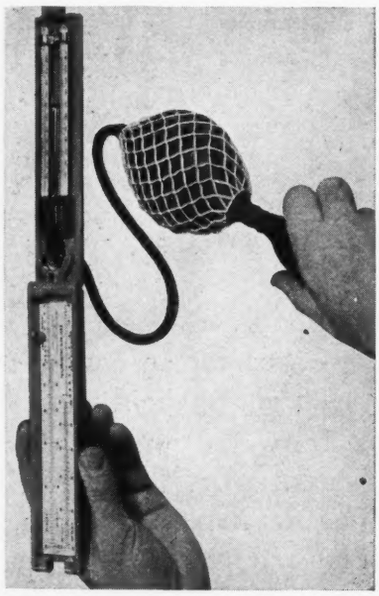
Watch for these "handbook" articles

1. Direct-current motors—February.
2. Alternating-current motors—April.
3. Diesel data—200 plants—June.
4. Engineering data on 400 modern steam and hydroelectric plants—September.

It Pays You to Read POWER Regularly

Psychrometer

HARD-ASPIRATED psychrometer is used for measurement of relative humidity. Typical air at the correct velocity is induced over the thermometer bulbs by use of the

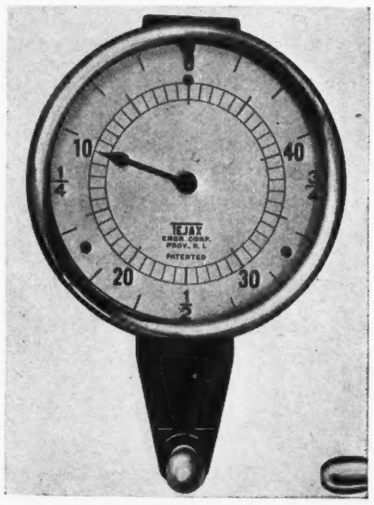


hand pump while operator holds instrument stationary and watches wet bulb reading move down to finality. Thermometers are shielded against radiation errors.

Julien P Friez & Sons, 4 N Central Ave, Baltimore, Md.

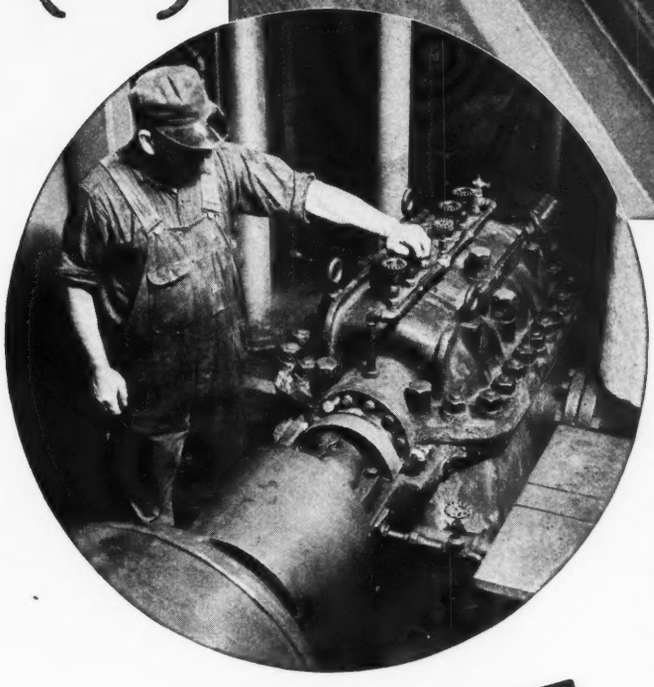
Dial Indicating Handwheel

MODEL No. 5-WC dial indicating handwheel for stems or shafts in a horizontal position, regulates and positions variable-speed drives, distance between rollers,



width of gates, shutters, dampers, and other equipment controlled by means of rotary or screw motion. Available with from 12 to 50 turns.

Tejax Engrg Corp, 1 Allens Ave, Providence, R. I.



8 MONTHS' *service*

GARLOCK 234 *Rotopac* Packing gives eight months' service on these 6-stage boiler feed pumps operating at 1800 R.P.M. and delivering 100 G.P.M. at 425 lbs. pressure, 230°F. Use GARLOCK 234 on all your rotary or centrifugal pumps handling hot water, cold water, caustic solutions or weak acids—for long, dependable service. All sizes from ⅛" to 1¼".

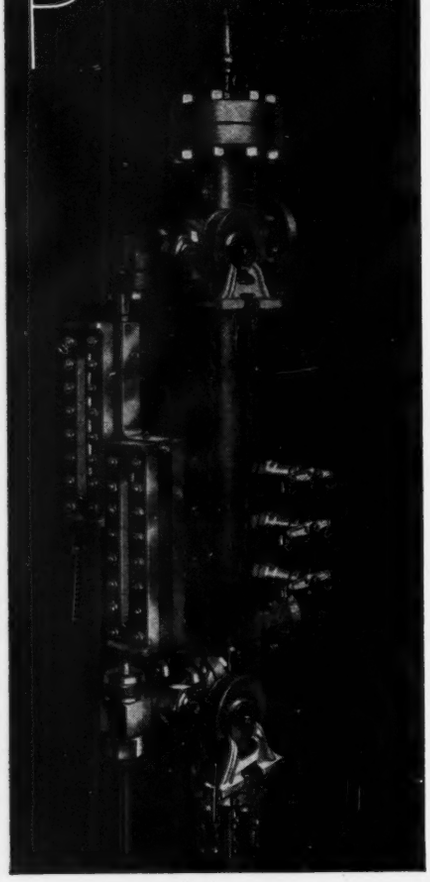
THE GARLOCK PACKING CO., PALMYRA, N. Y.

In Canada: The Garlock Packing Co. of Canada Ltd., Montreal, Que.

GARLOCK 234

Coil—GARLOCK 234
Rings—GARLOCK 239

POSITIVE
Protection



Yarway's unique Hi-Lo Alarm mechanism utilizes balanced *solid weights* that are as indestructible and unchanging as the metal itself. Operating on the displacement principle, they literally "weigh the water level."

When the high or low water emergency occurs—instant, positive, powerful, hair-trigger *action* results—giving warning of danger by whistle, light, or both.

Yarway Water Columns, eight standard models, iron bodies with screwed connections for pressures up to 250 lbs., forged steel bodies with flanged connections for pressures up to 1500 lbs., are fully described in Catalog WG-1806. Write for a copy and working model.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia

YARWAY
FLOATLESS HI-LO ALARM
WATER COLUMN

Power Lines

(*Continued from page* 110)

in the student training course. After serving for two years in the army and navy during the war, and two more years with other companies, he rejoined the Westinghouse Co, as a member of the porcelain sales staff.

W H HALL, professor of Civil Engineering and dean of the Division of Engineering at Duke University, has been appointed Dean of Engineering of the newly organized College of Engineering. The Division of Engineering was formerly administered as part of Trinity College.

JAMES L ASHLEY, secretary and treasurer of the International Nickel Co of Canada, Ltd, has decided to retire from active business under the company's retirement plan. He will continue to serve the company in an advisory capacity for several months.

RALPH M HOFFMAN, vice-president and sales manager of Link-Belt Co, Pacific Div, San Francisco for the last 8 years, has been appointed assistant to the president of the parent organization, Link-Belt Co, with headquarters at Chicago. Mr. Hoffman, a graduate mechanical engineer, University of Minnesota, 1911, came to the Link-Belt Co in 1923 as manager of Link-

Ralph M Hoffman

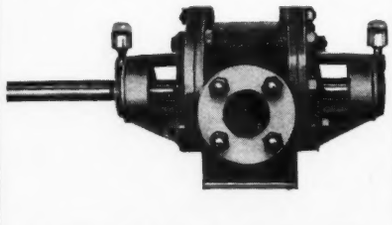
Belt Meese & Gottfried Co's Seattle Branch. He served in this capacity until 1931, the name of the branch being changed in the meanwhile to Pacific Div. From 1931 to 1939 he served as vice-president and sales manager of this subsidiary, with headquarters at San Francisco.

GEORGE F BERTRAND has become associated with the Sheffler-Gross Corp as sales engineer. He will specialize in the sale of air-conditioning devices sold by the company. During the past fifteen years he has had experience in designing, construction and testing of air-conditioning systems.

W H DAVIDSON, 1600 Walnut St, Philadelphia, Pa., has been appointed representative of the DeWolf Furnace Corp, 77 South Ave, Rochester, N. Y. His territory

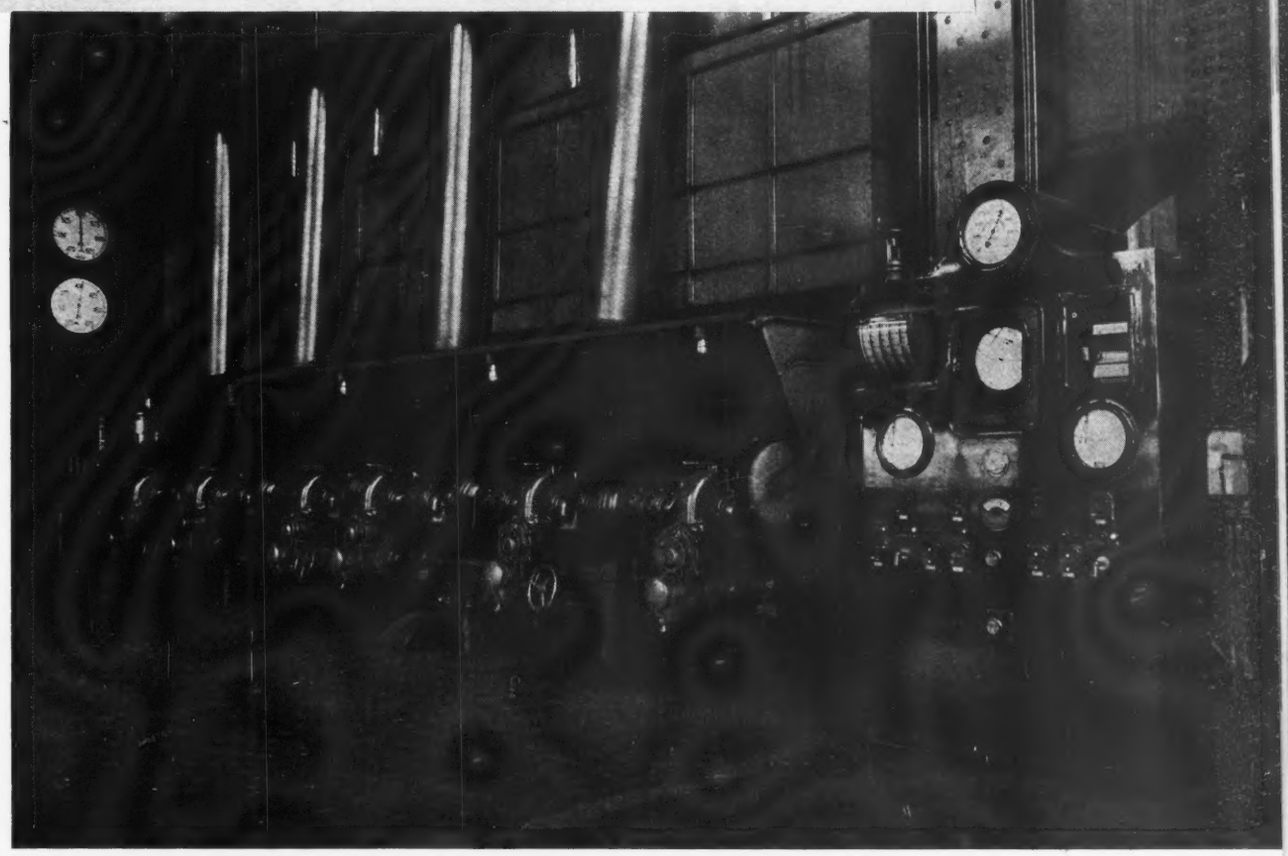
Is Old Man Time ready to put the finger on your pumps? Well, beat him to the punch and start the new year off right by replacing worn out units with new, sturdy, economical Viking Rotary Pumps.

Viking High Pressure Pumps are suitable for many varied applications. They are particularly adapted to installations where space is at a premium. Bulletin 1601-34 is all you need . . . it gives full specifications, pictures of models and many helpful pumping hints. Write for a copy.



VIKING
PUMP COMPANY
CEDAR FALLS — IOWA

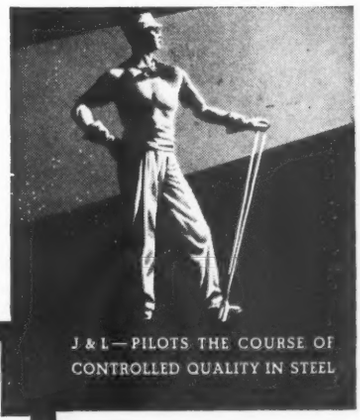
J&L SEAMLESS STEEL BOILER TUBES ASSURE SAFETY AND ECONOMY IN THE MAINTENANCE AND OPERATION OF YOUR BOILERS • • • •



J & L Boiler Tubes keep boilers working efficiently and economically because into every length of J & L seamless tubes is built an extra margin of strength and safety. There are no welds; therefore, there can be no failure at or near a weld — boilers stay on the job longer with fewer costly shut-downs.

When replacements or repairs are necessary, J & L Boiler Tubes form easily, roll in faster and they "stay put." Installations in power and manufacturing plants all over the country are proving that J & L Seamless Steel Boiler Tubes help make maintenance dollars go further.

The next time you need boiler tubes, specify J & L Seamless. Make sure you get tubes that give you low installation cost and last longer. Write today for a copy of the J & L Seamless Steel Boiler Tube Bulletin.



J & L — PILOTS THE COURSE OF CONTROLLED QUALITY IN STEEL

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS
PITTSBURGH, PENNSYLVANIA

J&L STEEL

J&L—PARTNER IN PROGRESS TO AMERICAN INDUSTRY

"JAGABI"
HAND
TACHOSCOPE

For Precise Measurements of Speed

THE Tachoscope will win your confidence immediately, because it uses the well-known "speed counter" and stop-watch method, but completely eliminates inaccuracies at starting and stopping. Its precision depends only on the lasting accuracy of a high grade watch mechanism. Giving you the exact number of revolutions in the exact time in which they were made, you *know* you are right! Good for all speeds up to 20,000 r.p.m. and 10,000 feet per minute. A truly accurate and dependable instrument for many kinds of speed measurement.

For showing fluctuations in speed, we recommend our Jagabi Types A and C direct-reading Hand Tachometers.

Write for Bulletin 1505-P, which describes an attractive variety of speed-measuring instruments.

JAMES G. BIDDLE CO.
ELECTRICAL INSTRUMENTS
1211-13 ARCH STREET PHILADELPHIA, PA.

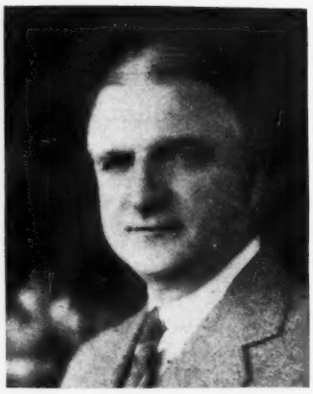
will include the southern portion of New Jersey, the eastern part of Pennsylvania, and the states of Delaware and Maryland.

DR OLIVER E BUCKLEY, executive vice-president of the Bell Telephone Laboratories in New York, has been elected chairman of the Engineering Foundation, research organization of the national engineering societies. Dr. Buckley succeeds the late Professor George E Beggs of Princeton University. He entered the organization which later became the Bell Telephone Laboratories in 1914. During the World War he had charge of the Signal Corps Laboratory, with the rank of major. In 1927 he became assistant director of research in the laboratories; in 1933 director of research, and in 1937 executive vice-president. He is a fellow of the American Institute of Electrical Engineers, the American Association for the Advancement of Science, the American Physical Society, and the Acoustical Society of America.

LEO W BRIGGS has joined the staff of the Western Precipitation Corp, Los Angeles, Calif., where he is now interested in new process development and the utilization of industrial wastes. He was formerly the general superintendent of the Gas Dept of the Compania Energia Rio Grande at Porto Alegre, Brazil, a subsidiary of the Electric Bond and Share Co, of New York, N. Y.

F M RUGGLES, of the Mullite Refractories Co, Shelton, Conn., has become midwest representative with headquarters in Chicago. He is a graduate ceramic engineer and enters the sales field with a technical background in refractories. His territory will include Illinois, Wisconsin and Missouri.

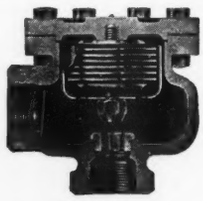
H B GAY, third vice-president and general sales manager of the Electric Storage Battery Co, retired from active service on December 1, 1939 after 38 years of service. Mr Gay began his career in the Sales De-



H B Gay

partment and was soon assigned to be manager of the Baltimore branch. In 1903 he was advanced to the managership of the Cleveland branch, which position he occupied for 17 years. He was transferred to Philadelphia in 1920 and became general sales manager. In 1926 he

NICHOLSON



TYPE "C"

NON-FREEZING - HIGH CAPACITY INDUSTRIAL STEAM TRAPS

Cannot freeze (can be placed right out in the weather); is never water-logged; cannot air-bind; intermittent discharge; largest water and air discharging capacity of any trap on the market; same size valve is used on vacuum as at 200 lbs.; moderate in price. "Nicholson" Industrial Trap Bulletin No. 439 on request. Sent on trial.

ALSO:—Nicholson Piston and Weight Operated Traps, Flexible Couplings, Expanding Mandrels, Arbor Presses, Compression Shaft Couplings, Steam Eliminators and Separators, Compressed Air Traps.

W. H. NICHOLSON & COMPANY
125 OREGON STREET
WILKES-BARRE PENNSYLVANIA, U.S.A.

Babbitt
Adjustable
SPROCKET RIM
with Chain Guide

KEEP YOUR MEN OFF LADDERS—
control valves from the floor

With Babbitt Sprocket Rims on your overhead valves, you can control valves instantly from the floor. Far quicker and safer than climbing ladders.

Babbitt Rims are easily attached in a few minutes, are inexpensive and assure safe, positive and instantaneous overhead valve operation. Available for valves of every make or style. Write for details.

BABBITT STEAM SPECIALTY CO.
New Bedford Mass.

SWARTWOUT CONTROLS

bring you low-cost dependable reducing and desuperheating..

... VITAL TO PRODUCTION THESE DAYS

THIS exacting service which you require with your modern higher pressure boilers is delivered efficiently and accurately by Swartwout Equipment. Whatever your needs in reducing, desuperheating and pressure control, Swartwout engineers are prepared to design and install the equipment best suited to handle your job with positive uniform results — and at low operating and maintenance expense.

This twin installation at the Carthage, Indiana plant of the Container Corporation of America handles 50,000 pounds of steam per hour when necessary, from their new (operating three years) high pressure boiler. It performs a double function — supplements turbine bleed and supplies all plant requirements when the high pressure turbine is off the line. • Swartwout gladly applies wide experience in this field to your problem. Write today for bulletins describing these control products and Swartwout service.

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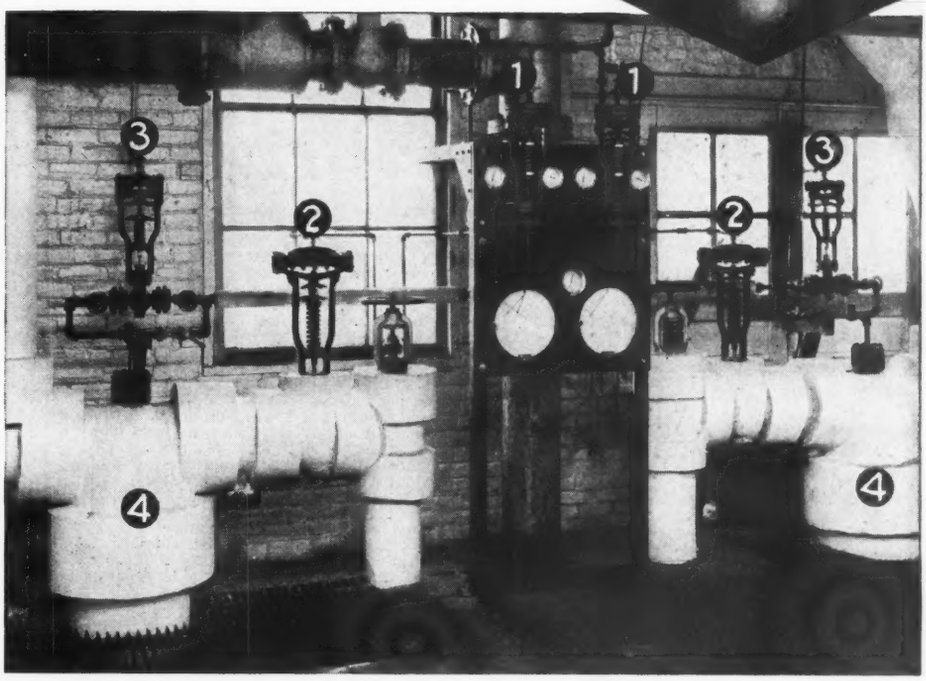
Philadelphia Consulting Engineers . . . selected this Swartwout Equipment to reduce and desuperheat steam from 575 pounds 175° superheat to a final condition of 160 pounds 50° superheat . . .



1 The two Swartwout Master Controls — the "brains" of the installation.

2 Swartwout Pressure Reducing Valves which are controlled by the Masters.

3 Swartwout Valves for controlling admission of water to maintain uniform discharge temperature.

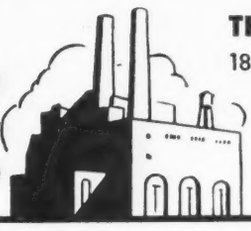
4 Swartwout Carburetor Type Desuperheaters.

•

Feed Water Regulators • Pump Governors • Feed Water Heaters
Master Controls • Reducing Valves • Separators • Exhaust Heads

Swartwout

•Power Plant Equipment•



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18501 Euclid Avenue • Cleveland, Ohio

★ ★ ★

Controlled **AIR CIRCULATION**
for Power Plants and Industrial Buildings

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In one instance after another a Henszey Meter or Flow Indicator has been installed when ordinary instruments have broken down, become inaccurate, or caused incessant trouble.

Why will these Henszey products stand up where others fail? Simply this: They were originally designed for the severe usage that they would encounter in the Henszey Continuous Blowdown System. Designed to withstand the abrasive action of hot, dirty blowdown water full of chemicals in solution as well as in suspension!

That's why engineers are specifying Henszey Meters and Flow Indicators to accurately tell the amount or rate of the flow of all hard-to-measure liquids!

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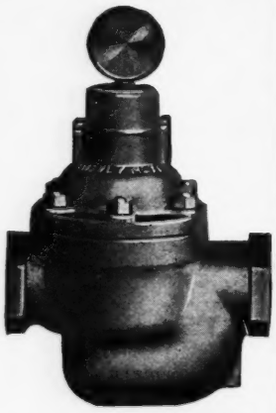
WATER METER



FLOW INDICATOR

HENSZEY

was elected fourth vice-president, in 1928 third vice-president and member of the board of directors.

FREDERICK H FEIKER, formerly a McGraw-Hill editor, has resigned his position as executive secretary of the American Engineering Council to become Dean of the School of Engineering of George Washington University. Mr. Feiker succeeds the late Dean John R Lapham, who died in October, 1939.

LOUIS H BRENDEL has been advanced from assistant sales manager of the Hancock Valve Div, Manning, Maxwell & Moore, Inc, to assistant to general sales

Louis H Brendel

manager. His new duties will include the supervision of sales promotion and jobber relations for the Ashcroft American Gauge Div, the Consolidated Safety Valve Div, the American Schaeffer & Budenberg Instrument Div, and the Hancock Valve Div.

STRAWS

Pointing the way business winds blow

ALABAMA——G E Tillman, 1703 Sixteenth Ave., Birmingham, and associates have concluded negotiations for purchase of ice-manufacturing plants of Manatee Ice & Fuel Co, Manatee; Ellenton Ice Co, Ellenton; Excelsior Ice Co, and Citizens' Ice Co, both Bradenton, all Florida. Plans are under way for improvements in different existing plants, with installation of additional equipment. Cost estimated close to $40,000. Plants noted will be operated under one management in future.

Woodward Iron Co, Birmingham, contracted Carrier Corp, Syracuse, N. Y., for installation of air-conditioning system at blast furnace, making second such unit at plant to be so equipped.

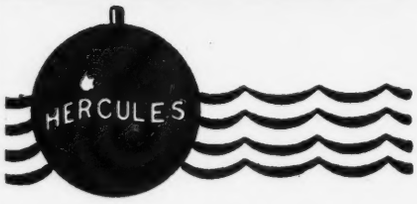
Pell City plans municipal natural-gas distribution system, with control station and operating facilities. Cost about $35,500. Financing has been arranged through Federal aid.

ARKANSAS——J T Turner, Parkin, plans 1-story ice-manufacturing and cold-storage plant on West Hill St, Forrest City. Installation will include diesel engines and accessory equipment for power service. Cost reported about $45,000.

CALIFORNIA —— Public Works Officer, Navy Yard, Mare Island, has low bid from Cory & Joslin, 50 Hawthorne St, San Francisco, at $64,328 for furnishing and installing boiler feed pumps, feedwater heater, circulating pump and miscellaneous accessories; steam, circulating water, fuel oil and bleeder piping, and incidental miscellaneous piping in central power plant at local yard, and will make award soon (Specifications 9456).

Bd of County Supervisors, Hall of Records, Los Angeles, will award contract soon for 3500-sq-ft watertube boiler and auxiliary equipment for installation in power house at Hall of Records.

HERCULES *Seamless Copper* **FLOATS**



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Fabricated of seamless copper under our special spinning process, Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

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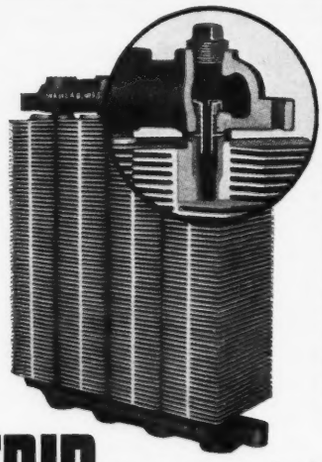

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The cutaway enlarged section above shows how Grid is made—no electrolytic action to cause corrosion—no maintenance—a unit made for long years of service.

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THE UNIT HEATER & COOLER CO.
Wausau, Wisconsin
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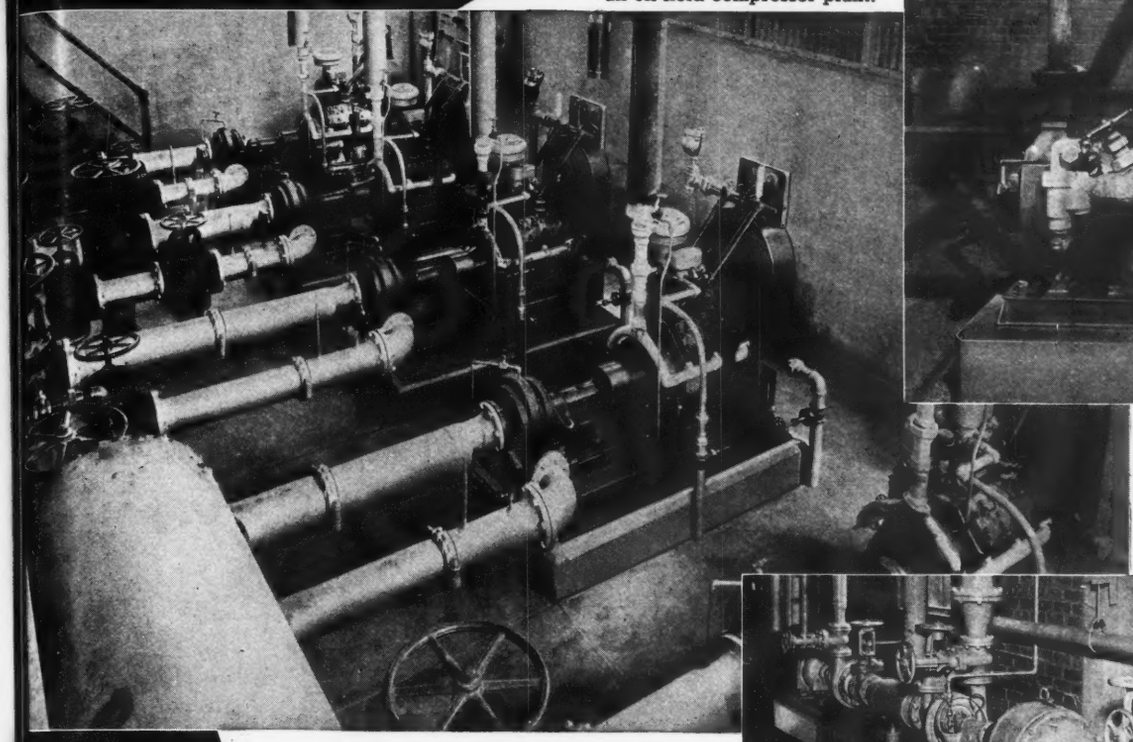
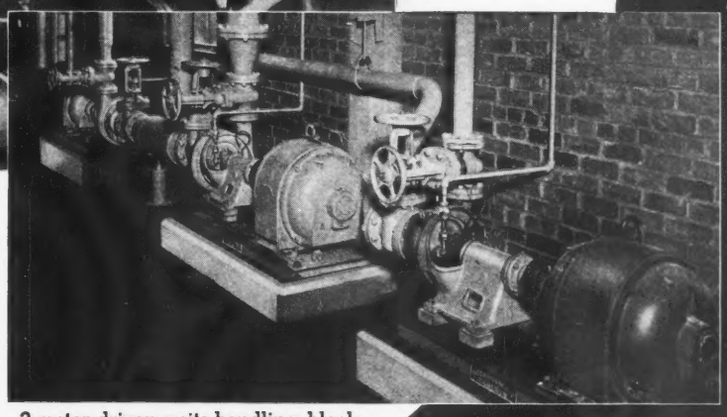
GRID UNIT HEATER

5 gas engine driven units handling water in an oil field compressor plant.

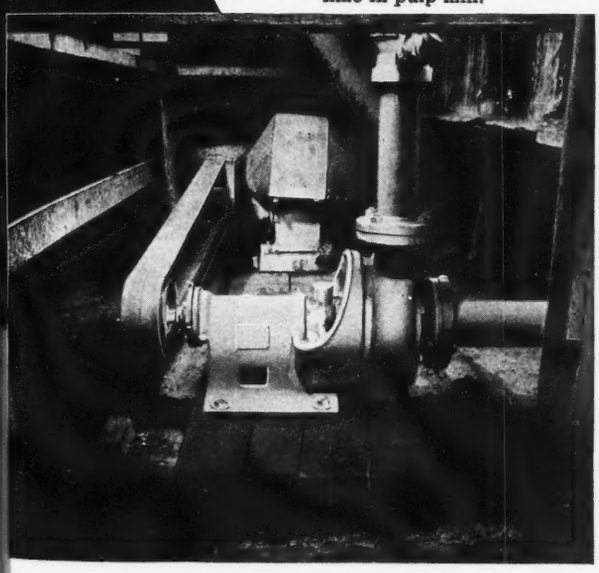


Turbine driven 2-stage unit handling oil in a refinery.

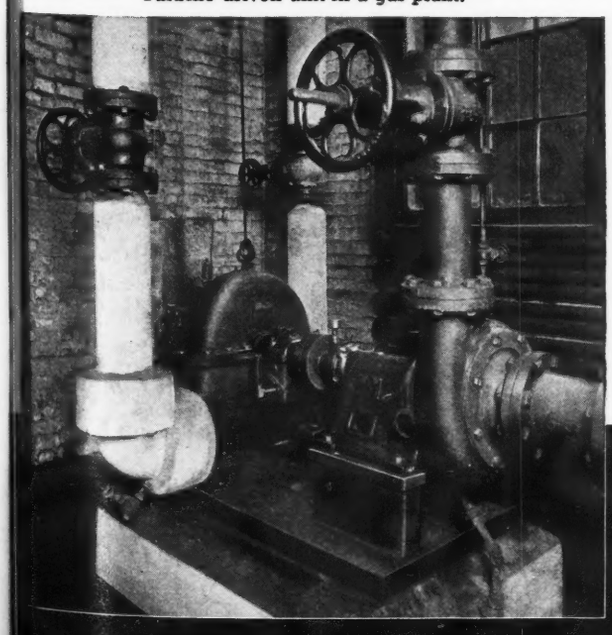


2 motor driven units handling black liquor in a paper mill.

A belt driven unit handling milk of lime in pulp mill.



Turbine driven unit in a gas plant.



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108

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"My job is to keep machines working. So I pack steam rods, pumps and valve stems with the best packing I can get. That's Greene, Tweed. It stands up longer than any other packing that I have ever used."

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Send for a working sample. Try it against any other packing. If Greene, Tweed does not outlast the other packing we don't want your business.

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PACKINGS

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CONNECTICUT——New Britain Machine Co, Chestnut St, New Britain, has filed plans for 1-story addition, to be equipped as a generator room, and will begin erection at once.

DELAWARE——E I duPont deNemours & Co, Inc, Rayon Div, duPont Bldg, Wilmington, approved plans for modernization in branch mill at Ampthill, Va. Work will be placed under way at once. Cost about $1,000,000 with machinery and power equipment.

FLORIDA——Construction Service, Veterans' Administration, Washington, D. C., will receive bids until Jan. 9 for installation of air-conditioning and ventilation systems at institution at Lake City.

GEORGIA——Crisp County Power Commission, Cordele, has approved immediate installation of new generating unit and auxiliary equipment in county-owned hydroelectric power plant on Flint River, making third such machine at plant.

Brunswick Pulp & Paper Co, Brunswick, plans improvements in bleached sulphate fiber mill, including new production units and modernization of present facilities. Cost about $500,000 with machinery and power equipment. Company is a joint interest of Scott Paper Co, Chester, Pa., and Mead Corp, Chillicothe, Ohio.

IDAHO——Bd of Regents, University of Idaho, Moscow, has deferred call for bids for proposed addition to power house at institution, with installation of new boiler units and auxiliaries. Proposed to take bids early in 1940. Cost about $90,000. Lincoln Bouillon, Fourth Ave, Bldg, Seattle, Wash., consulting engineer.

ILLINOIS——Carlyle has awarded contracts for improvements to the municipal light and power plant as follows: For 1000-kw turbine-generator and condenser to the Westinghouse Electric & Mfg Co, E Pittsburgh, Pa., at $47,695; for the general construction of building, etc, to Krall & Co, Decatur, Ill., at $68,673, and for a radial brick stack to Alphons Custodis Chimney Construction Co, Chicago, at $4,940.

George D Roper Corp, Blackhawk Park Ave, Rockford, plans two 1-story additions to stove-manufacturing plant, each about 130x165 ft. Cost estimated over $85,000 with machinery and power equipment. Bradley & Bradley, 226 North Main St, architects.

INDIANA——Cummins Engine Co, Columbus, has awarded contract for 10,000 sq ft research and development laboratory to the Austin Co, and is scheduled to be finished the first part of this year. Machine shop, 50x100 ft will be provided, together with special metallurgical laboratories.

Huntington will award contracts soon for improvements in municipal power plant, including new diesel-generator unit and accessories, water-softening apparatus, 500,000-gal elevated steel tank, and miscellaneous equipment. Lennox & Matthews, Architects' and Builders' Bldg, Indianapolis, consulting engineers.

Bd of Public Works, Decatur, contracted General Electric Co, Schenectady, N. Y., at $113,000 for 5000-kw turbine-generator unit and auxiliaries for installation in municipal power plant, where modernization program will be carried out. Also let contract to Westinghouse Electric & Mfg Co, East Pittsburgh, Pa., at $34,000 for condenser. Awards for 4000-sq-ft boiler and miscellaneous equipment will be made soon. Entire project reported to cost over $400,000. Froehlich & Emery Engrg Co, 2nd National Bank Bldg, Toledo, Ohio, consulting engineer.

Bd of Public Works, Logansport, has low bid at $59,750 from Johnson-Larsen & Co, 6530 Beaubien St, Detroit, Mich., for high-pressure piping installation and auxiliary equipment for municipal power plant, where improvements are being made, and will place award soon. Charles Ammerman, Century Bldg, Indianapolis, consulting engineer.

American Maize Products Co, 135 South LaSalle St, Chicago, Ill., plans four additions to starch-manufacturing plant at Roby, comprising a 4-story structure, 110x200 ft, 5-story, 42x52 ft, and two 1-story units. Cost about $250,000 with machinery and power equipment. Sargent & Lundy, Inc, 140 South Dearborn St, Chicago, consulting engineers.

Central State Hospital, West Washington St, Indianapolis, will build 1-story boiler house, 43x50 ft, for service at institution, to include 2 return tubular boilers, stokers, vacuum pump, circulating pump and auxiliary equipment. O A Tislow, Architects' and Builders' Bldg, architect.

Hammond Housing Authority, Hammond, is considering central-heating plant

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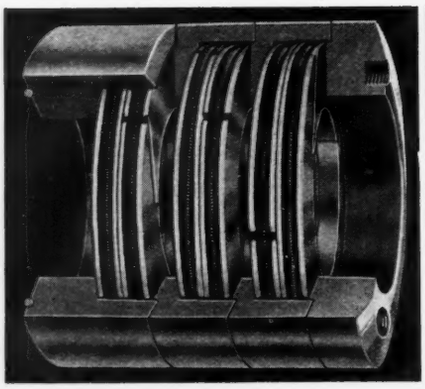

RESOLUTION for 1940

And the Years Ahead

- *prevent rod scoring*
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"Full-floating" FRANCE rings in metal cases make a snug seal and compensate for rod deflection or misalignment—the ideal packing for piston rods and valve stems in any type of engine, pump or compressor whether the motion is reciprocating or oscillating. Wears as long as any other working part of the engine—prevents expensive power shutdowns.

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Original **FRANCE METAL PACKING**

for new low-cost housing development on local site. Cost about $1,200,000. Proposed to carry out work as soon as financing has been concluded through Federal aid. R S Kastendieck, 673 Broadway, Gary, architect; H E Beine, City Hall, Gary, engineer.

IOWA——Estherville contracted Busch-Sulzer Brothers Diesel Engine Co, St. Louis, Mo., at $108,730 for diesel-generator unit and auxiliary equipment for installation in municipal electric power plant, where improvements are being carried out.

Cedar Falls city officials hope to take bids early this year on the construction of the proposed municipal hydroelectric power plant on Cedar River. C H Streeter, city engineer, has estimated the cost at $100,000.

Rath Packing Co, Sycamore and Elm Sts, Waterloo, will soon begin work on multi-story addition to power house at meat-packing plant, 40x60 ft, for addition to engine room, where additional equipment will be installed. Cost reported over $85,000 with equipment. Henschien, Everds & Crombie, 59 East Van Buren St, Chicago, Ill., architects and engineers.

Fort Dodge contracted James Leffel & Co, Springfield, Ohio, for 600-hp, vertical-type hydraulic turbine for municipal hydroelectric power plant, to be used with electric generator unit previously purchased. Entire project will cost about $60,000.

Waukon will make surveys and estimates of cost for new municipal power plant. Proposed to use diesel-generators and accessories. Hubbard Engrg Co, 80 East Jackson Blvd, Chicago, Ill., consulting engineer.

KANSAS——McPherson recently awarded contracts for new equipment for the municipal power plant as follows: Airsuit breaker type switchgear, Westinghouse, to Zimmerman Electric Co, Wichita, at $48,361, and General Electric transformers to Graybar Electric Co, Kansas City, Mo., at $6,646.

Kansas Electric Power Co, Lawrence, contracted Marley Co, Kansas City, for new cooling tower at power plant at Emporia. Cost about $25,000.

KENTUCKY——Corbin recently awarded a contract for power piping at the municipal power plant to the General Piping Corp, Detroit, Mich., at $31,945. Burns & McDonnell Engrg Co, 107 West Linwood Blvd, Kansas City, Mo., consulting engineers.

LOUISIANA——Great Southern Box Co, New Orleans, plans 1-story corrugated box-manufacturing plant, 70x250 ft, at East Jackson, Miss. A boiler house will be built. Cost estimated about $150,000. Work is scheduled to begin early in 1940.

Masonic Temple Bldg, St. Charles and Perdido Sts, New Orleans, care Leo S Weil and Walter B Moses, 427 South Peters St, engineers, will award contract soon for installation of 350-ton capacity air-conditioning system, to include cooling tower, switchboard and controls, etc. Cost about $200,000.

MARYLAND——United States Engineer Office, Postoffice Bldg, Baltimore, will take bids soon for two new pumping plants for installation at outlet works to Toby Creek pressure culvert, near Kingston, Pa. Also at later date will ask bids for series of five similar pumping plants in vicinity of Wilkes-Barre, Pa.

MASSACHUSETTS——Metropolitan District Commission, Sewer Div, 20 Somerset St, Boston, J P Dever, chief engineer, plans large electric-operated pumping station in connection with new sewage disposal station. Entire project will cost over $3,000,000. Greeley & Hansen, 6 North Michigan Ave, Chicago, Ill.; and Metcalf & Eddy, Statler Bldg, Boston, consulting engineers.

Lawrence Housing Authority, Bay State Bldg, Lawrence, John J Darcy, chairman, plans central-heating plant for new local housing development. Entire project will cost about $1,650,000. M J Dyer Co, 1 Beacon St, Boston, architect.

MICHIGAN——State Agricultural Bd, Lansing, plans addition to power plant at Michigan State College, East Lansing, with installation of new equipment. Cost about $160,000.

Twin City Packing Co, Menominee, will begin work soon on new boiler house at plant, about 20x38 ft, with 36-in. dia brick stack, 80 ft high. Derrick Hubert, 1065 Sheridan Rd, architect.

Construction Service, Veterans' Administration, Washington, D. C., has low bid from Drake Avery Co, 147 West Woodbridge St, Detroit, at $36,779 for new boiler plant at institution at Dearborn, and will make award soon.

West Michigan Consumers Co, Muske-

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WITH the new MAXIM SILENCER, MODEL BR9, our engineers have developed an efficient, practical, easily installed means of taking the noise out of high velocity steam, air or gas discharges—an ideal method of quieting the roar from safety valve and relief valve discharges.

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NEW YORK, N. Y.

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. . . to the big things and little things done each month by operators and manufacturers across the country to raise plant efficiencies, cut costs, and reduce trouble.

It Pays You to

Read POWER Regularly

Start the New Year . . . WITH THE NEWEST INFORMATION ON THERMOMETERS AND FLOW METER SERVICE

With 1940 comes a new chance to take a *forward-looking* view of plant needs, and of today's equipment for meeting them. There's no better time than right now to make sure you're fully up-to-date in your knowledge of the profit possibilities of modern Thermometers and Flow Meters under 1940 conditions. And there's no better way to begin a check-up than by looking over these informative new bulletins which Foxboro has just received from the printer.

Most foresighted operating men, we know, watch "new equipment" notices right along for ideas and improvements that can bring better performance or lowered costs to their own operations. In the field of instrument service, though, every week brings new applications . . . better ways of doing things . . . possibilities for savings confirmed in actual plant experience.

That's why we say: Why not spend a few minutes in stock-taking for the New Year? Why not make sure you've got a clear-cut picture of 1940 instrument models and 1940 instrument methods? Once you've looked these bulletins over, you'll be prepared to make a sounder analysis of problems in which temperature is a factor, or in which the flow of steam, liquids or gas affects costs or product quality. Short of calling in a Foxboro specialist to advise you in attacking a specific problem, it's your best way of being fully informed on profit-building instrument performance. **The Foxboro Company, 68 Neponset Avenue, Foxboro, Mass., U. S. A.** Branch offices in 25 principal cities.

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The Foxboro Company
68 Neponset Avenue
Foxboro, Mass.

☐ Please send me, *by mail*, your newly revised 40-page Bulletin 198-2, "Recording Thermometers" which, in addition to a complete review of types, specifications, ranges of 1940 Foxboro Recording Thermometers, also contains valuable installation suggestions.

☐ Please send me, *by mail*, your newly revised 48-page Bulletin 200-4, "Meters for Steam, Liquids, Gas," which I understand will give me a good picture of meter service as well as design features and specifications.

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Company.....

Address.....

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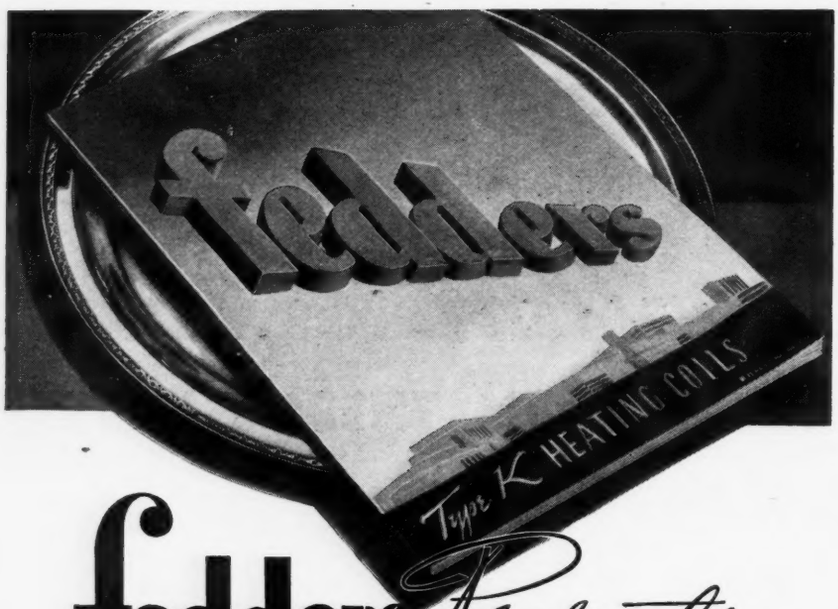

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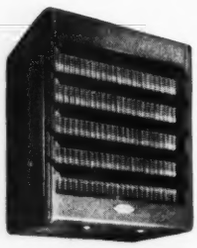

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Concern .....

Street .....City .....

gon, contracted Williams Brothers Corp, National Bank of Tulsa Bldg, Tulsa, Okla., for new 8-in. welded-steel pipe line from gas-field areas in Kent County, to Ravenna, near Grand Rapids, about 21 mi, for natural-gas transmission to new gasoline absorption plant of Pent-Hex Corp, Muskegon, a subsidiary interest, to be located in that district. Pipeline will cost about $100,000.

MINNESOTA——Henning has low bid at $52,437 from Fairbanks, Morse & Co, Chicago, Ill., for engine-generator unit for municipal power plant, and will make award soon. Also, low bid from James Leck Construction Co, Metropolitan Bank Bldg, Minneapolis, at $17,358 for erection of power station building. Bond issue recently was approved for project. Burlingame, Hitchcock & Estabrook, Inc, Sexton Bldg, Minneapolis, consulting engineer.

St. Hilaire Co-operative Creamery Association, St. Hilaire, Ray Randorf, secretary, plans cold-storage plant with locker system at local creamery and milk-products plant. Cost estimated close to $40,000.

Fairmont Canning Co, Winnebago, is considering installation of new freezing department for vegetables. Estimates of cost will be made soon. Proposed to begin work early next spring.

Milan Creamery, Milan, S S Lundborg, head, plans installation of cold-storage plant, with locker system. Cost reported about $30,000.

Rushford plans municipal power plant. Proposed to use diesel-generating units and accessories. Cost about $80,000. Work scheduled to begin early in 1940. Ealy G Briggs, 1957 University Ave, St. Paul, Minn., consulting engineer.

Warren Co-operative Creamery Association, Warren, Ralph E Melbo, manager, plans cold-storage and refrigerating plant addition to local creamery, with installation of locker system. Estimates of cost are being made.

Northern States Power Co, Minneapolis, has plans for new steam-electric generating plant at St. Cloud, with multi-story building, 60 x 120 ft, and installation of 7500-kw turbine-generator unit and accessories, high-pressure boilers and auxiliary equipment. Work scheduled to begin next spring. Cost about $600,000.

Alvarado Co-operative Creamery, Inc, Alvarado, plans cold-storage and refrigerating plant addition, with locker system comprising an initial installation of 100 units, and ultimate capacity of 250 locker units. Cost estimated close to $45,000.

MISSISSIPPI——Natchez will award contract soon for engine-generator unit and auxiliary equipment for installation in municipal power house and waterworks station. Proposed to use diesel-type unit. Fund of $60,000 has been arranged. This is part of waterworks improvement project to cost about $300,000.

Kosciusko plans improvements in municipal power plant, with installation of new engine-generator unit and auxiliary equipment. Cost about $70,000. Bond issue is being arranged.

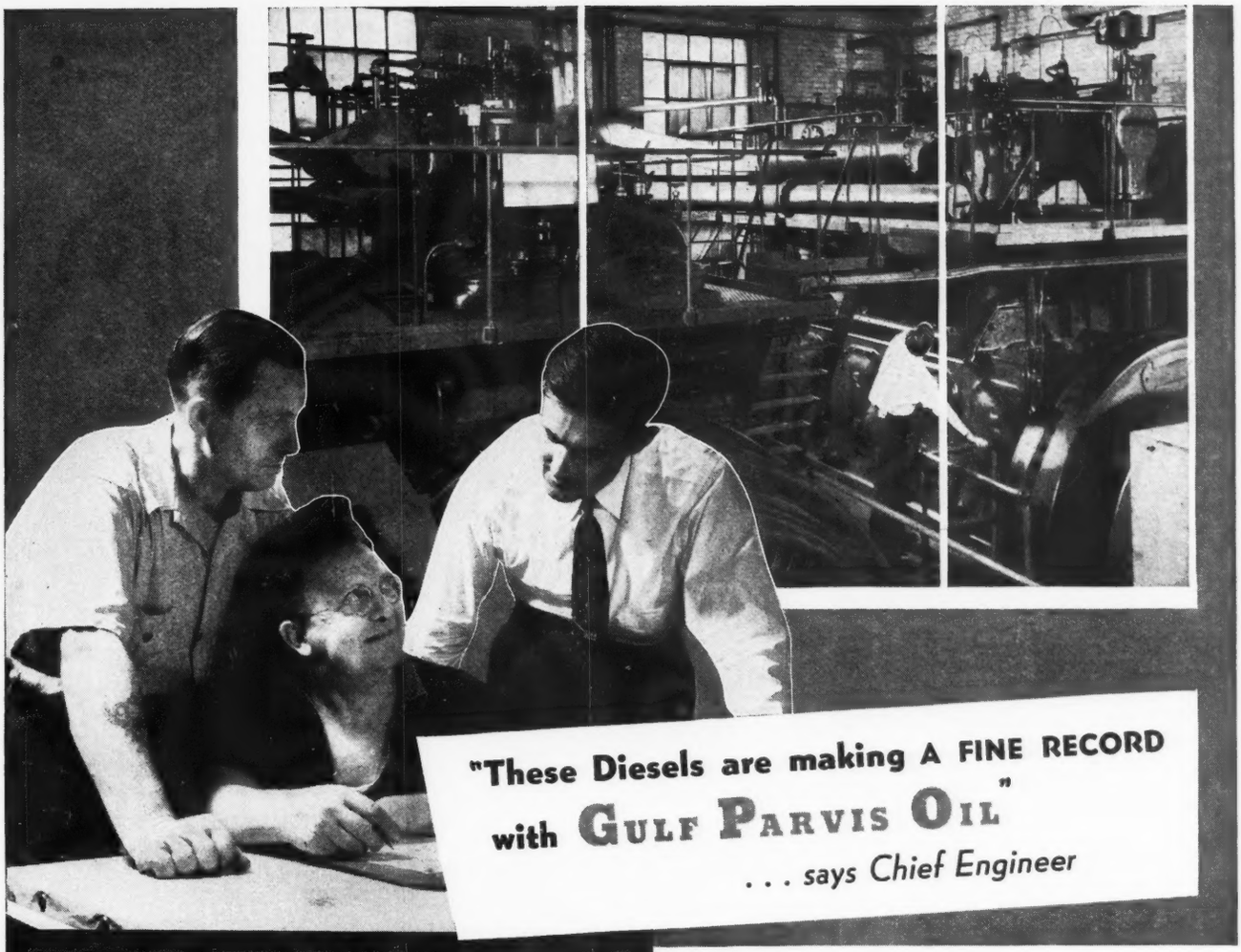
MONTANA——Glacier Silver-Lead Mining Co, Libby, approved plans for power house at properties near Libby, with installation to include two diesel-generator units and auxiliary equipment. Cost over $60,000.

NEVADA —— Consolidated Coppermines Corp, 120 Broadway, New York, is considering new concentrating mill for production of blister copper at mining properties at Kimberly, comprising several units, equipped to handle about 8000 tons of ore per day. A power house will be built. Entire project will cost close to $5,000,000. Ira B Joralemon, 315 Montgomery St, San Francisco, Calif., mining engineer, has been retained to make a survey and report on project.

NEW HAMPSHIRE——Ashuelot Reel Co, Winchester, plans rebuilding of portion of wire reel and spool-manufacturing plant, recently destroyed by fire. Loss reported over $100,000 with machinery and power equipment; reconstruction will approximate like amount.

New Hampshire Electric Co-operative, Inc, 46 West Main St, Concord, has plans maturing for new electric power plant for service for rural electric system. Fund of $385,000 has been secured through Federal aid for station and rural lines. J R Worcester & Co, 79 Milk St, Boston, Mass., consulting engineers.

NEW MEXICO——El Paso Natural Gas Co, Bassett Tower Bldg, El Paso, Tex., plans compressor station, power house, pumping station and other mechanical structures at new natural gasoline plant near Jal, Lea County. Also will build a



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4 GULF PARVIS OILS reduce operating costs. Because of the stability and high lubricating quality of these oils, wear and repair expense are minimized. Lower oil consumption and lower maintenance costs reflect substantial savings in over-all operating costs.

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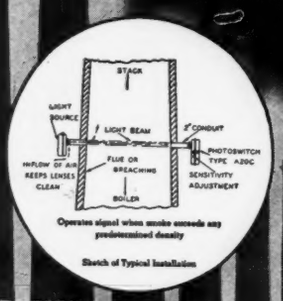

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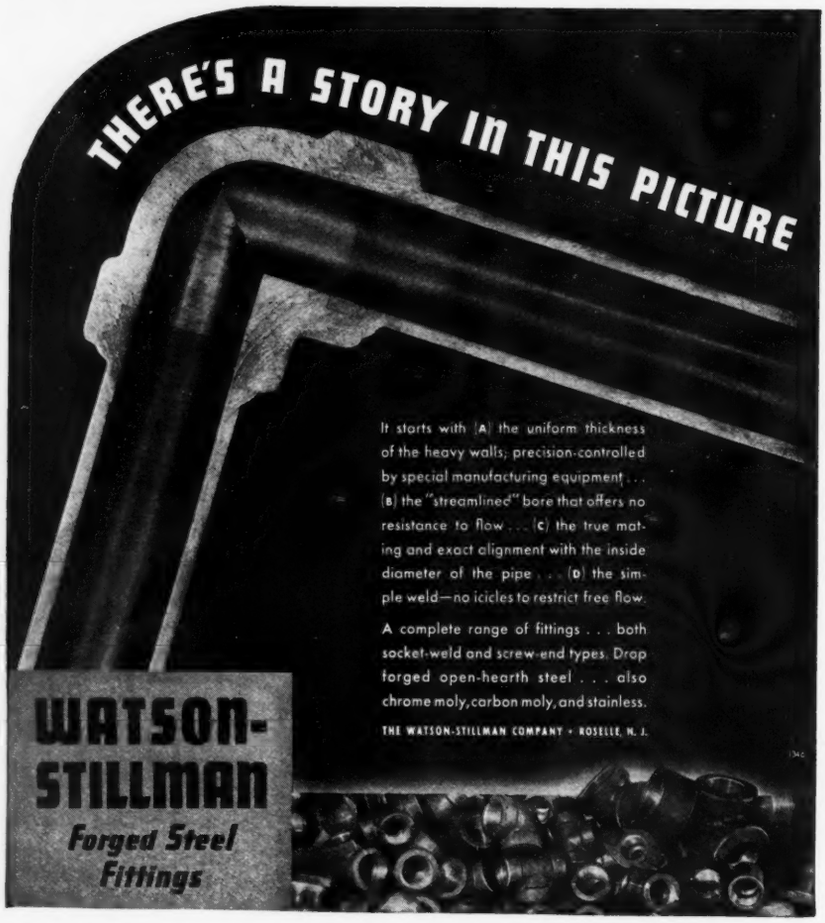
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A complete range of fittings . . . both socket-weld and screw-end types. Drop forged open-hearth steel . . . also chrome moly, carbon moly, and stainless.
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steel pipeline gathering system for natural gas supply for processing. Entire project will cost close to $1,000,000.

NEW YORK——Niagara Brine Co, Inc, care of Ford, Bacon & Davis, Inc, 39 Broadway, New York, consulting engineer, organized recently by chemical interests at Niagara Falls, has plans maturing for development of salt deposits in vicinity of Linden, Genesee County, for salt brine production, to be conveyed by new pipe line from that point to Niagara Falls. Installation at supply source will include hydraulic pumping units to develop a large lake of continuous salt brine, power station, salt-purifying plant, water reservoir with pumping station, and other mechanical units. Pipe line will be about 60 miles long, formed of special metal pipe to resist brine action; it will be operated under pressure, and pumping stations will be installed for booster service at points along route. Cost estimated about $1,500,000. Work will bgin early in 1940. Engineers noted are in charge.

OHIO——Standard Oil Co of Ohio, Midland Bldg, Cleveland, Ohio, will begin work soon on new 6-in. welded-steel pipeline from Dayton to Springfield, for gasoline transmission, including new bulk terminal, with steel tanks, pumping station and other operating facilities. Cost close to $200,000.

Piqua has low bid from General Piping Corp, 5050 Joy Blvd, Detroit, Mich., at $36,465 for installation of piping system in municipal power, where improvements are being made, and will make award soon. Burns & McDonnell Engrg Co, 107 West Linwood Blvd, Kansas City, Mo., consulting engineer.

Sabina has engaged Fosdick & Hilmer, Union Trust Bldg, Cincinnati, consulting engineers, to prepare plans for proposed improvements in municipal power plant and waterworks station. Installation will include diesel-generator unit and accessories. Cost about $42,000. Bond issue in that amount was authorized recently.

Cleveland Metropolitan Housing Authority, Housing Center, West Mall Dr, Cleveland, **Ernest J. Bohn, director, plans** central heating system in extension to Outhwaite housing project, comprising about 490 units of 3-story apartments, with group of 2-story dwellings. Present power plant in Outhwaite Apartments, same district, will be enlarged and additional equipment installed. Entire project will cost about $3,000,000. Maier & Walsh, 10006 Carnegie Ave, and R Franklin Outcalt, 13124 Shaker Sq, associate architects.

St. Mary's has plans maturing for improvements in municipal power plant, including installation of new 2500-kw steam-turbine-generator and accessories, condenser, boiler unit and auxiliary equipment. Cost about $230,000. Bond issue in that amount will be sold soon.

Dept of Public Service, Miamisburg, plans early purchase of boiler unit, stoker and auxiliary equipment for installation in municipal power plant. Also will carry out further improvements at later date, with installation of new turbine-generator and accessories. Leo Wall, city engineer.

Hydraulic Press Mfg Co, Mount Gilead, plans several new 1-story additions for increased capacity. Cost about $500,000 with machinery and power equipment. Financing has been arranged through sale of preferred and common stock issues. Work is scheduled to be carried out in 1940.

Cleveland Electric Illuminating Co, Cleveland, has let following contracts to date for equipment for new steam-electric generating plant on Lake Front Rd and 70th St, N E, on which erection is scheduled to begin early in 1940; Turbine-generator, General Electric Co., Schenectady, N. Y.; condensers, Worthington Pump & Machinery Corp., Harrison, N. J.; high-pressure boilers, Babcock & Wilcox Co, New York, N. Y.; pulverized fuel equipment, Combustion Engrg Co, New York; precipitators, Research Corp, Bound Brook, N. J.; and piping, valves, etc., Pittsburgh Piping & Equipment Co. Awards for miscellaneous equipment will be made at later date. Cost about $6,300,000.

Ohio Public Service Co, T O Kennedy, general manager, plans $3,000,000 expansion program, to include the building of new facilities, extension of service lines and rehabilitation of present equipment.

OKLAHOMA——Dept of Interior, Washington, D. C., will award contract soon for new power house at Chilocco Indian School, Chilocco, 46 x 196 ft, a portion of unit to be used for a mechanical laundry. Installation will include one

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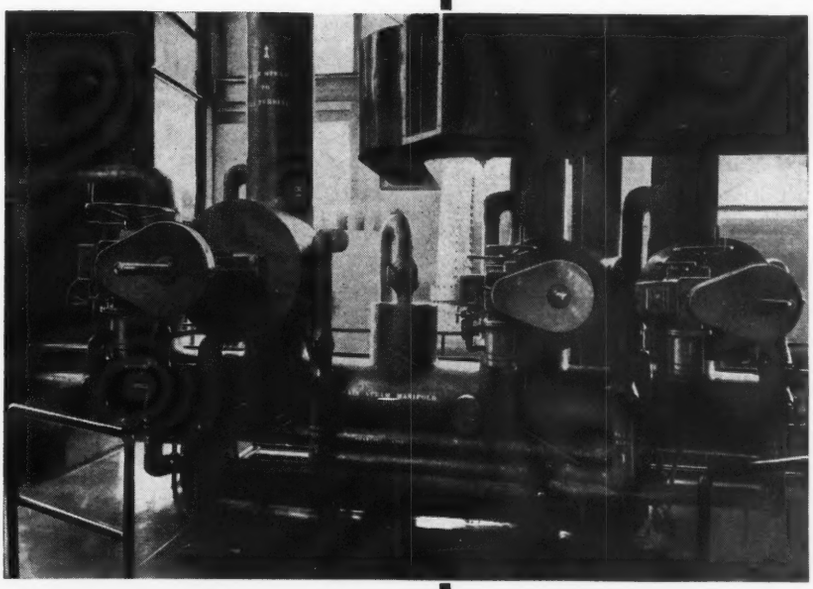
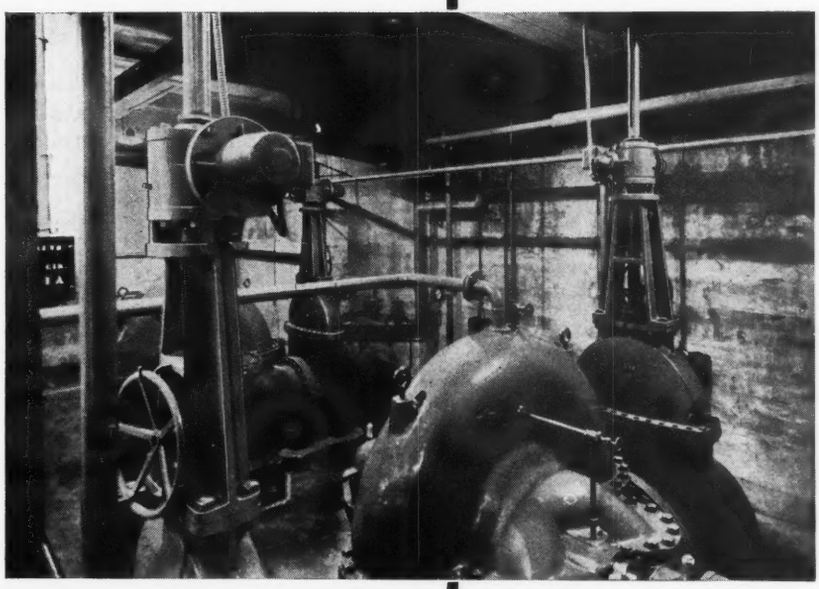
with . . . .

Philadelphia LIMITORQUE VALVE CONTROLS





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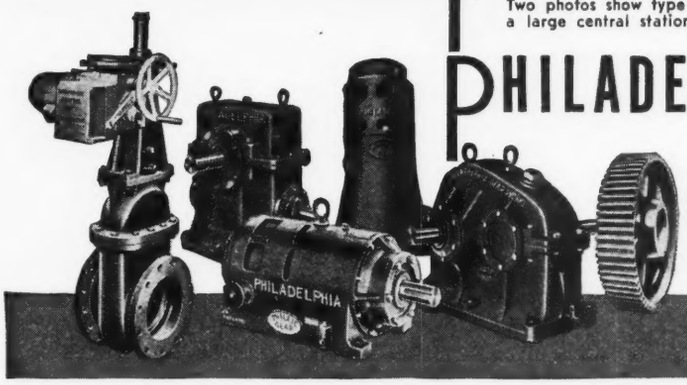

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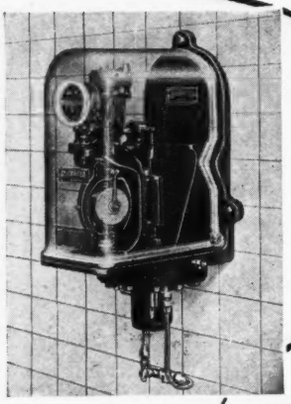

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3500-sq-ft and one 1500-sq-ft watertube boilers, water-softening apparatus, feedwater heater and accessories.

PENNSYLVANIA—Standard Pressed Steel Co, Jenkintown, shop equipment manufacturers, are commencing erection of 12,000 sq ft addition to main plant. New structure is to be of steel, brick and glass construction.

C A Reed Mfg Co, Chestnut St, Williamsport, plans 2-story and basement addition, 80 x 180 ft, to paper products plant. Cost close to $70,000 with machinery and power equipment. Clarence E Wagner, 51 West Third St, architect.

General State Authority, Harrisburg, contracted Coxe Stoker Engrg Co, Markle Bank Bldg, Hazleton, for alterations and improvements in boiler plant at Allentown State Hospital, Allentown, including installation of equipment.

TENNESSEE —— Knoxville Electric Power and Water Board recently awarded a contract to the Allis-Chalmers Mfg Co, Milwaukee, Wis., at $53,555 for Contract D-1 of the power plant improvement program, including receiving station such as main switching equipment, new outdoor oil circuit breakers, addition to network substation and improvements to electric distribution system.

TEXAS——Coleman will award contract soon for 750-kw turbine-generator unit and accessories, 5000-lb watertube boiler, surface condenser, two centrifugal boiler feed pumps, and auxiliary equipment for installation in municipal light and power plant, where improvements will be carried out. Terrell-Bartlett Engineers, Smith-Young Tower Bldg, San Antonio, consulting engineers.

Panhandle Eastern Pipe Line Co, 101 West 11th St, Kansas City, Mo, is arranging appropriation of about $3,500,000 for additions to welded-steel pipelines from Texas Panhandle area to Illinois, Indiana and Michigan, with branches in number of other States, including Kansas, Missouri, Oklahoma, etc, used for natural-gas-transmission. Proposed to build about 142 mi of 22 and 24-in., and smaller size for laterals. New compressor plants will be installed at different points for booster service, and present combination gasoline-dehydration plant will be extended, with equipment installation for increased capacity. Project will be carried out this year. J D Creveling, president.

Luling Foundation, Luling, plans cold-storage plant and locker system in new meat-processing plant, with refrigerating department for egg storage. Work will begin early in 1940. Cost estimated over $50,000 with equipment. Noonan & Wilson, Builders' Exchange Bldg, architects; Lloyd D Royer, Smith-Young Tower Bldg, mechanical engineer, both San Antonio.

Angelina County Lumber Co, Lufkin, plans boiler house in connection with proposed rebuilding of lumber and sawmill at Keltys, about 2 mi from Lufkin, recently destroyed by fire. Loss estimated over $150,000.

VIRGINIA——South Hill contracted Chicago Pneumatic Tool Co, 6 East 44th St, New York, N. Y., for new municipal power plant, with installation of three 300-hp diesel-generator units and auxiliary equipment. Cost about $150,000. Wiley & Wilson, Peoples' National Bank Bldg, Lynchburg, consulting engineers.

WASHINGTON——Constructing Quartermaster, McChord Field, Tacoma, contracted University Plumbing & Heating Co, 3929 University Way, Seattle, at $22,240, for new sewage pumping stations Nos 1, 2 and 3 at local field, including pumping units and accessories.

WEST VIRGINIA——Independent Ice Co, Central Ave, Charleston, approved plans for 1-story ice-manufacturing plant. Cost about $40,000, of which close to $25,000 will be expended for equipment.

West Penn Power Co, West Penn Bldg, Pittsburgh, Pa., has plans maturing for improvements in Windsor power plant, Beechbottom, with installation of new 60,000-kw turbine-generator unit and accessories, high-pressure boilers and auxiliary equipment. Station is operated jointly with Ohio Power Co, Newark, Ohio. Cost reported over $1,500,000 including line construction. Work is scheduled to be carried out in 1940.

WISCONSIN——Wisconsin Gas & Electric Co, Racine, R E Moody, executive vice-president, announces that company has awarded contract to United Engineers & Constructors, Philadelphia, Pa., for the reconstruction of 25 coke ovens at the Racine plant.

Carnation Co, North Van Buren St, Milwaukee, plans 1-story condensed-milk-processing plant at Statesville, N. C., where site has been acquired, consisting of several units. Cost about $200,000 with machinery and power equipment.

Appleton Coated Paper Co, North Meade St, Appleton, contracted Koepke Construction Co, Appleton, for addition to power house at mill, for improvements in engine room. Additional equipment will be installed. Cost reported close to $30,000.

Modine Mfg Co, 17th St, Racine, manufacturer of air-conditioning apparatus, etc, contracted Austin Co, 16112 Euclid Ave, Cleveland, Ohio, for new boiler house at plant. Cost reported over $45,000 with equipment.

Fennimore plans early call for bids for new municipal power plant, using diesel-generating units and accessories. Fund of $70,000 has been approved for project, with completion scheduled late in 1940. George H Leiser, Portage, consulting engineer.

Rubber Mountings Increase Rope Life

ABOUT TWO YEARS ago noises originating in an elevator machine and its controller in an apartment house caused tenants to enter legal proceedings to break their leases. We mounted the two passenger-elevator machines on rubber mountings similar to those described in a recent POWER article "Rubber Mountings Cut Elevator Noises." These machines have a capacity of 3000 lb at 300 ft per min.

The rubber mountings were satisfactory beyond our expectations. We were surprised when the elevators rode more evenly in the hoistway, especially when changing from one motor winding to the other during the acceleration and retardation and when the brake finally set. The harsh grabbing that usually accompanies a 2-speed motor job was noticeably absent.

The elevator machine in the penthouse moves downward and upward perceptibly every time an abrupt control or brake application takes place. This accounts for the smooth operation of the elevator cars.

We next installed rubber mountings for noise-insulating purposes on the elevator machines in another apartment house. These are duplicates of those already described. The machines always developed considerable creepage of hoist ropes on the traction sheaves; metal cuttings from these sheaves could be found on the bed plate. Ropes on all the elevators mentioned had used from 8 to 12 months of their life when the mountings were installed. Since installation of the mountings, approximately two years ago, we have not replaced a set of hoist ropes on any of these elevators. We assume that the cushioning effect of the rubber mountings prevents the extreme loads on the ropes that normally occur in this type of elevator during acceleration and retardation.

Detroit, Mich. H C GAITHER
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